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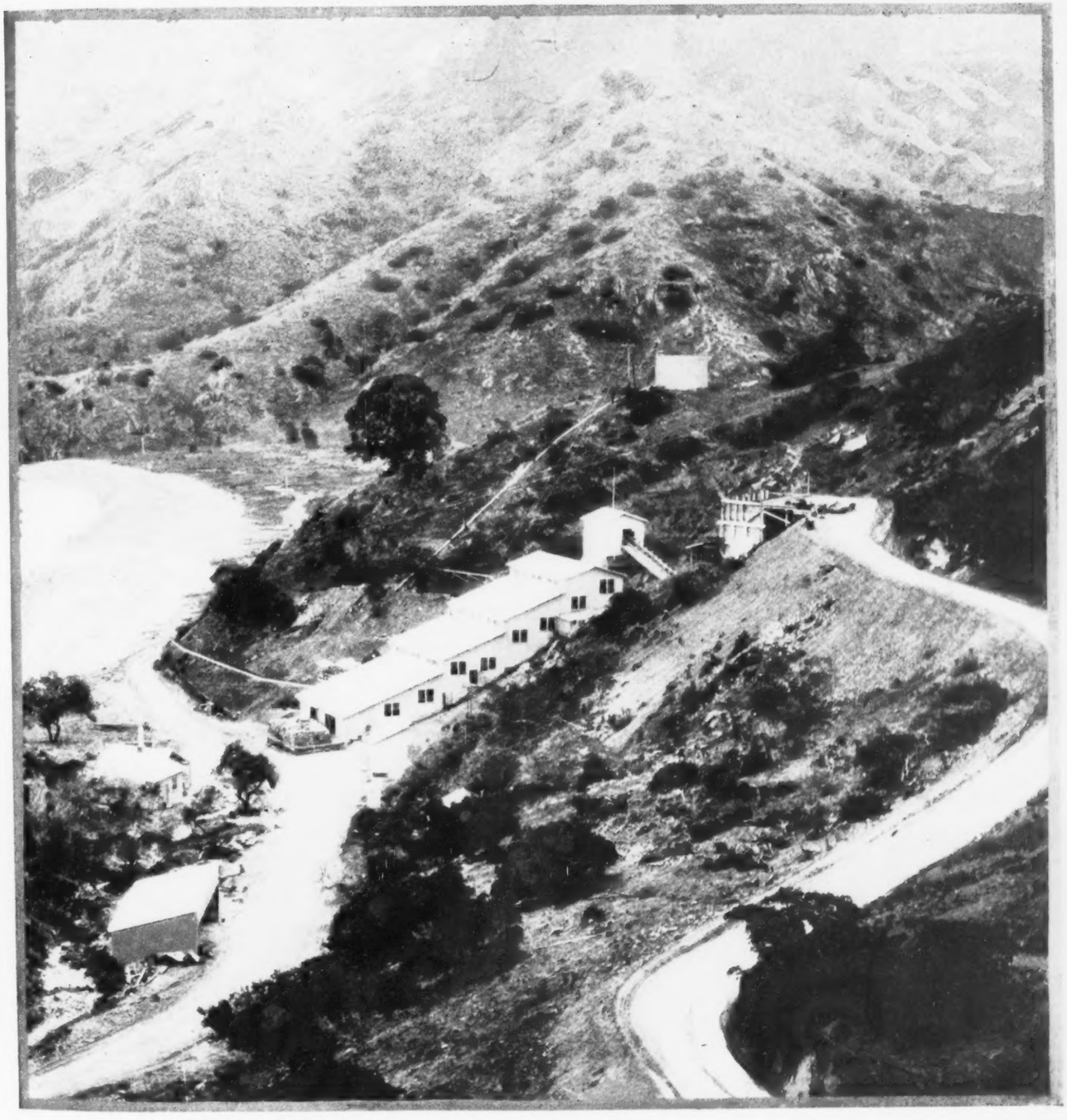
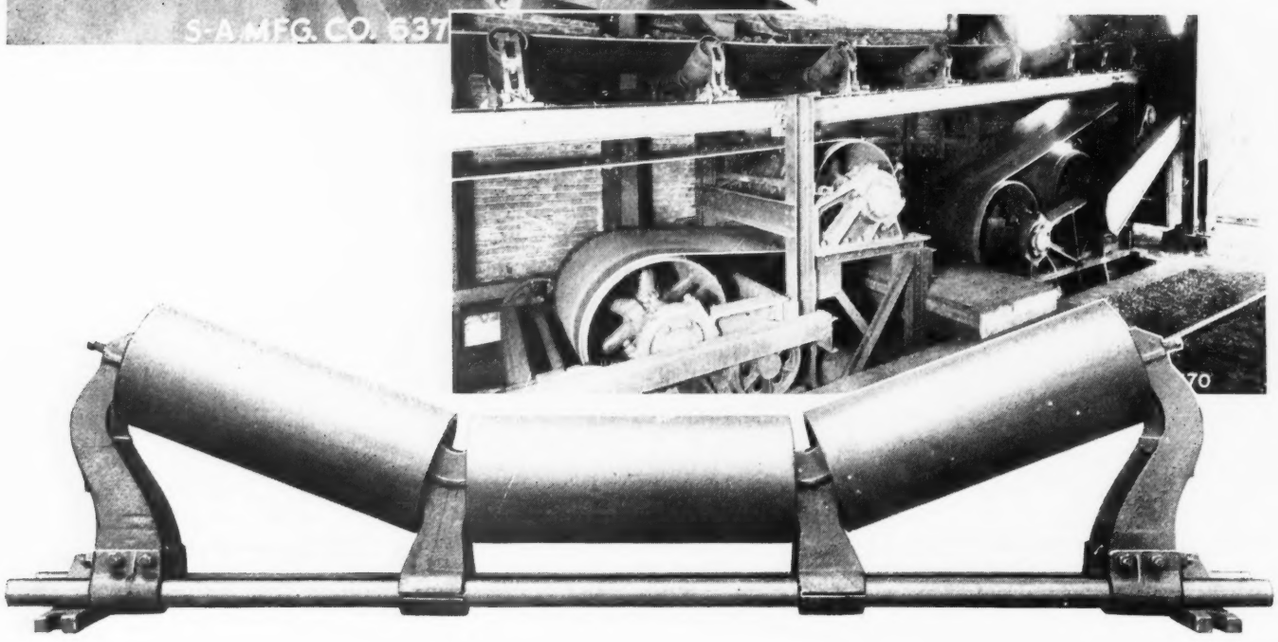


Single Roll Crushers, by W. T. W. Miller—Selecting a Stoping Method, by Charles A. Mitke—Canadian Crystalline Graphite and the World's Market, by H. P. H. Brumell—Empire Mining and Metallurgical Congress



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Volume 124 New York, September 24, 1927 *Number* 13

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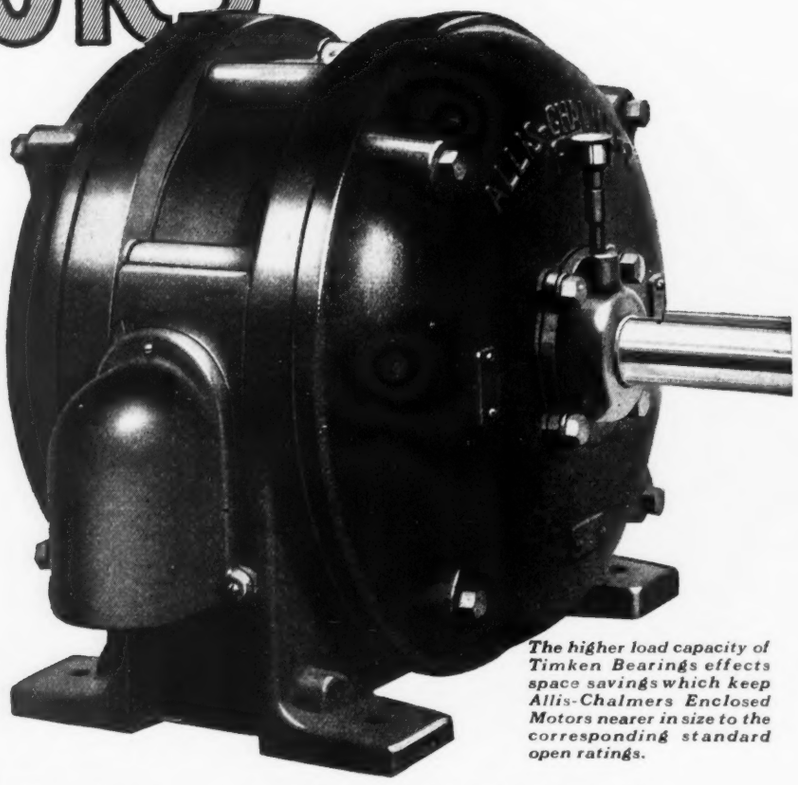

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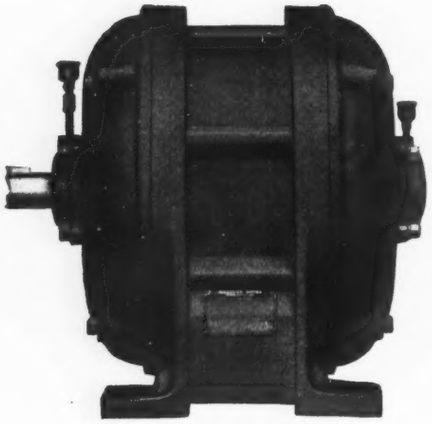

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VOLUME 124 New York, September 24, 1927 NUMBER 13

To Our Friends of the Mining Industry:

IT is with much satisfaction that I am able to inform our friends that Arthur W. Allen, well known to the mining industry for his hydrometallurgical work and as a former member of the staff of *Engineering and Mining Journal* and of *Mining and Scientific Press*, has been appointed editor of *Engineering and Mining Journal* and will take up his new duties at once. This appointment brings to an editorial chair distinguished by Raymond, Rothwell, Rickard, Ingalls, and Spurr, an engineer of wide experience, achievement, and reputation, who is at the same time an accomplished journalist.

Graduated from Cambridge in 1902, he was continuously engaged in professional practice until he joined the staff of this journal in 1917. His engagements have covered work in the United States, Mexico, South America, Australia, and Africa. While his specialty has been the wet processing of ore and other raw materials, he has always been a close student of mining methods and of the business problems of the mining industry. His grasp of these subjects has been abundantly shown in his editorial work.

His service on the staffs of this paper and *Mining and Scientific Press* has been between his engagements of the last ten years. His writings include books on the cyanide process, ore dressing, and nitrate recovery.

Mr. Allen, therefore, comes with exceptional qualifications to this post. To journalistic experience he adds broad and thorough knowledge of the industry and its personnel, a sympathy and understanding of mining men and methods not only here but abroad, and a character and cultural attainments that command respect and friends.

I commend him most heartily to the industry which it will be his privilege to serve in the responsible and commanding position of editor of *Engineering and Mining Journal*. He will, I am sure, be a worthy successor of the distinguished men who have preceded him.

JAMES H. MCGRAW.

A Seasonal Trend in Metal Prices?

SEASONAL TRENDS are important in some industries, buying being stimulated or depressed by hot weather or by cold weather; by wet weather or by dry; or by the approach of the year-end holidays. Some non-metallic minerals, such as gypsum, phosphate, and potash, are affected by seasonal demands, but most of the non-ferrous metals are considered to be in fairly uniform demand the year round. A possible exception, in the popular mind, is tin, the statement being occasionally made that prices are likely to advance during the fall months. That there is some truth in this is evidenced by a study of comparative prices on Sept. 1 and Nov. 30 for the last six years; it will be found that without exception the price of prompt Straits tin has undergone an advance in this period. In fact, if the period from Aug. 1 to Nov. 30 be taken, instead of the period beginning Sept. 1, the advance is even more striking. In this four months' period the smallest advance was 3c. (from 26¾ to 29¾ in 1921) and the largest advance 8⅞c., in 1923. The average advance in the six-year period studied was 12 per cent. In other words, if the price of tin on Aug. 1 were 65c., as it was this year, one might expect it to be about 73c. at the end of November, based on recent precedent.

This consideration of the autumnal trend in tin prices stimulated a similar inquiry into those of copper, lead, and zinc. It was found that in five of the last six years —all except 1926—zinc prices also advanced in this four-month period. The average advance for the six years, including the one year when a decline was registered, was 0.56c. or 9 per cent. In other words, again based on recent precedent, the price of zinc, which was 6.40c. on the first of last August, might be expected to be 7c. by the end of November.

Similarly for lead: as with zinc, in only one year—and that was also in 1926—did the price go down between Aug. 1 and Nov. 30, and the average advance was almost the same as for zinc, or 0.58c., which was 8½ per cent. August and early September of the current year have been unfavorable for lead prices and it seems decidedly unlikely that the Aug. 1 price of 6.65c. will harden to 7¼c. by the end of November, for as this is written it is only 6¼c. However, but for this apparent seasonal trend it might be even lower.

Copper, however, refuses to be tractable, advancing in only two years of the period under review, and declining in the other four—another reason for hope for advancing copper prices this fall unfortunately gone!

In this study, price data previous to 1921 have not been considered because of the unsettlement owing to war and post-war conditions in the years 1914 to 1920. Furthermore, buying habits have changed in recent years, so that it is dangerous to delve too much into history to secure data on which to predict the future, as students of economics have learned to their chagrin.

This price increase of tin, lead, and zinc during the fall months in this period may of course be a coincidence, for no very good reason can be offered at the moment as to why it should occur. Perhaps some reasons could be found by further study. In the case of tin, it has been suggested that the consumption of tin in tin- and terneplate is greater towards the end of the year than before Aug. 1, but consumption statistics for the last four years

do not indicate such a condition. In fact, if anything, consumption seems to be greater during the first four months of the year. Perhaps as good a reason as any that can be offered at the moment is that in the hot weather purchasing agents are thinking more of golfing, boating, and surf bathing than they are of buying metal; then they come into the market during the fall and are sufficiently active factors to cause an advancing market.

At any rate, these words of encouragement are cheerfully offered to the lead, zinc, and tin producers, and may 1927 be a repetition of the past. As for copper, the price seems in no immediate danger of going lower than it was on the first of August, and something more substantial than precedent may serve to put it up.

Solving the Lead-Zinc Problem

THE recent regional meeting at Salt Lake City was in substance an inventory of the present status of selective flotation, with a survey of its effects in the mining industry and a study of technical details. A splendid cross-section of the Western mining industry was represented in the attendance. Interest was keen.

For several years there has been discussion about the "revival" of the mining industry, but the revival that is generally meant has to do with the speculative side of mining and is slow to reach realization. The real and present revival of lead-zinc mining in the mountain states has been brought about by selective flotation. Owing to the foresight of two smelting companies who saw their business dwindling, custom concentration plants were established in Utah and selective flotation was applied to lead-zinc ores upon a commercial basis, which greatly encouraged the miners. Chief credit for this turn of the corner is no doubt due to J. O. Elton. The progress made in Utah was shown by W. Mont Ferry, who stated at the meeting that in 1924 zinc concentrates to the amount of 24,000 tons were marketed; in 1925, 60,000 tons; in 1926, 144,000 tons; and it is estimated that in 1927 150,000 tons will be marketed. In the current year it is estimated by Mr. Ferry that the gross returns to the Utah mines from zinc concentrates will amount to $6,000,000. A similar result has taken place in Colorado and in Nevada and Idaho. In addition to this gross return in Utah, Mr. Ferry estimated that the indirect return to the mining companies by reason of lower smelting charges and diminished penalties will amount to a saving of $3,500,000 in 1927. Parenthetically, with these income increases the miners have forgotten their past grievances with the smelters, and the present situation is a happy one, for the smelters are smelting, the miners are receiving many more dollars, and the railroad companies are hauling more ore and concentrates at reduced rates.

Mining has been rejuvenated for the lead-zinc miners by the development and application of modern technical methods. For a long time the methods used were only partly successful. The jig and the concentrating table were devices that were valuable but needed supplementing; magnetizing roasting and magnetic separation yielded satisfactory results on some ores; electrostatic methods were successful to a limited extent; and selective mining and hand sorting were also tried out, in some instances more or less successfully. But in spite of this progress the lead smelters were still confronted with the difficulty of handling lead-silver ores associated with large quantities of zinc. The only practical method was to force the zinc into the slags, a practice which entailed the use of large proportions of flux and resulted in high smelting charges. Both miners and smelters were forced into a corner from which they have escaped through selective flotation.

The electrolytic zinc process has also become an important factor in the solution of the lead-zinc metallurgical problem. Hydro-electric power is abundant in the Western states, but industrial applications are relatively few. Particularly in Montana there was a surplus of hydro power. Production of electrolytic zinc became a means of utilizing this cheap power, but this required a continuous supply of zinc concentrates. Montana supplied a moderate quantity, but it was apparent that a wider supply was needed; now, Utah and other Western states are adding an important tonnage to the supply of the Great Falls plant.

This brief account would not be complete unless mention is made of another phase of the lead-zinc problem which technical research has mastered. This is concerned with the recovery of the zinc lost for a time in the accumulated slags at the lead smelters. The Anaconda company is erecting a slag-retreatment plant for the recovery of zinc from the lead blast furnace slags at the East Helena smelter, electric furnaces being used. The commercial success of this plant will mean an additional source of zinc, without mine depletion.

The Sutro Tunnel and the Comstock

THE recent death of Theodore Sutro in New York recalls the Comstock. Theodore Sutro was the brother of Adolph Sutro, whose initiative and enterprise conceived the idea of the Sutro Tunnel and completed its construction in the face of physical and financial difficulties that appeared at times unsurmountable. The idea of a mining adit that would serve for drainage, ventilation, and working was thus brought prominently before the mining industry and subsequently became widely adopted when topographic conditions were favorable. Compressed-air locomotives and rock drills were used in the construction of the Sutro Tunnel, the prominence of this mining project definitely turning the attention of miners to mechanization, with the result that the development and use of power-driven machines has since been an outstanding feature of the progress of mining.

As a coincidence, the *Nevada State Journal* has recently stated that the Consolidated Virginia is now inactive. Consolidated Virginia was one of the Bonanza mines of the 'seventies. The "bonanza kings," Mackay, Fair, Flood, and O'Brien, derived vast fortunes from it. Its subsequent history contains little of note, as after spectacular production in its heyday it became the plaything of the stock market and sank into comparative unimportance. A recent attempt to work low-grade ores above the Sutro Tunnel level petered out. The failure of the United Comstock and the subsequent failure of the Comstock Merger company shows how difficult a task it is to rejuvenate the older mining districts.

The Comstock deserves an important niche in the history of mining. Its discovery, following not so long after the discovery of gold in California, did much to start the West definitely upon its mining activities; to

produce a group of men who became interested in mining and who made the industry. Those who made their stakes and dropped out were succeeded by many others. The great industry of the present in the Western states found much of its initial impetus in the bonanzas of the Comstock and the fortunes dug from the alluvials of the Sierran foothills.

Making Capitalists Out of "Workers"

ONE of the important trends of industrial evolution is toward employee ownership. This may range all the way from the ownership by high executives of a comparatively small portion of the company's securities, to complete ownership by as many employees as care to take advantage of the privilege. That the desirability of such employee ownership in corporations has been brought to the attention of the employees by far-seeing executives, rather than as a result of agitation and demand on the part of labor itself, indicates that the management believes that the corporation in question will function more satisfactorily if the employees are financially interested in their work beyond the weekly or monthly pay check.

Though the ownership of a small stock interest does not give the holder much if any voice in the management, some companies have also found it advisable to extend privileges in this direction. The Bethlehem Steel Corporation, for instance, is conspicuous among great American industrial enterprises in its policy of promoting joint management by company and employees of such matters as affect working conditions. Recently, the corporation distributed to all of its employees a statement in which its president, E. G. Grace, says:

"Real progress in the relations between employer and employee is promoted by a substantial participation of the employees in the joint management of matters which directly affect their working conditions, as well as in the ownership of the business. These are essential parts of the forward-looking labor policy which Bethlehem has established in co-operation with its employees.

"One of the most helpful results of this policy is the increasing interest of the employees in the business of the company, especially in those activities which are jointly operated for their benefit, and which they help us to run.

"It is only logical that these activities—pensions, relief, employee representation, saving and stock ownership, home building, safety and first aid—should be the subject of an occasional report to the employees, just as the corporation affords to stockholders at annual meetings."

The extent to which stock ownership and a voice in management by employees is practicable depends upon circumstances. In large-scale, stable operations it may well be considered for manual workers as well as for technical men and the official personnel, especially if length of employment be taken into consideration in apportioning stock to the first-named class. Many mining companies have adopted some modification of the idea, feeling that a share in ownership not only causes the employee to take more interest in his work, and makes for his mental contentment and financial responsibility, but, especially in the case of employees on the lower rung of the ladder, tends to decrease labor turnover, which is often serious and far more economically wasteful than is generally suspected.

That Emergency Stock of Manganese

SO IMPORTANT is manganese as an essential for making steel that any program of war-preparedness in the United States must give first consideration to insuring that a supply of manganese ore sufficient for the government's war-time steel requirements shall be readily available in case a sudden war cuts off foreign imports before the infant domestic industry has reached a point where it can take care of domestic needs. Officials of the War and Navy departments appreciate how necessary this is. They are said to have given their approval to the Manganese subcommittee's recommendations that the government purchase, over a period of nine years, a total of 600,000 tons of manganese ores of ferro grade and hold it in storage as an emergency war supply. This plan was discussed at the manganese meeting in Cleveland last spring. Objection on economic grounds to such procedure is outweighed by the facts of the vital importance of the mineral as a war supply and the particular situation at the present time regarding its production.

This measure would be an excellent one for the government to take. Not only would it meet an important requisite of national preparedness, but it also would afford the government a means, in addition to the protective tariff, of encouraging the growth of the domestic manganese industry, which is now in the early stage of its development. For the government, in purchasing this manganese ore, if the plan proposed is made possible by suitable legislation, could give—and should give—preference to manganese ores produced at home over those imported from abroad, even if those abroad are produced by American capital. Such preferential treatment for domestic ores, crude or beneficiated, would be entirely justified, if they were sold at the prevailing open market and met the government's specifications as to analysis, grade, and tonnage.

At the moment the domestic output is far too small for domestic needs, but projects of importance are under way that promise a steady increase for the future. If in any year of the nine-year period the domestic output were less than the amount sought by the government in that year, the balance could be made up from foreign sources. The funds necessary for these purchases would be provided by the tariff collected on imported ore. These purchases, it should be borne in mind, would be for storage against emergency and not for the current requirements of the steel industry, so that the imported tonnage would possibly still be large for several years to come.

Preferential treatment of this legitimate sort for domestic ores would furthermore be warranted, for it would hasten the development of the domestic industry, by assuring it a wider market at the outset than would otherwise be open to it. By the time the nine-year purchasing program of the government had been completed, it is likely that the domestic industry would be so well established that the question of an emergency supply of manganese ore would be of no importance.

The government must be assured of its war-time manganese supply, if there is any meaning to preparedness. It is hoped that the next Congress will pass the necessary legislation to permit the acquisition of an emergency stock of ore, as has been recommended. This legislation ought to stipulate, as a matter of national self-interest, that preference be accorded domestic ores to the fullest possible extent.

Mining Engineers of Note

HENRY COFFIN CARLISLE

FOR four generations the forbears of Henry Coffin Carlisle operated whaling ships from Nantucket Island and it is therefore not a surprise that an adventurous spirit should have led him to spend his life in hunting mines and in studying the possibilities of various mining districts. He graduated from the mining course at Yale and then worked as a post-graduate for two years at Columbia, where he received a mining engineering degree in 1910. In spite of the documentary evidence of his training he did not at once set out as an engineer but put in a two-years' "apprenticeship" in various minor capacities in Arizona, at the property of the Ray Consolidated Copper Co. Following this experience he was placed in charge of a drilling crew engaged in exploring a supposed "porphyry copper" in Nevada. On completion of this work he entered the employ of the Tonopah Mining Co. of Nevada, at the outset finding himself at the operating end of a muck stick. This ordeal lasted only four months, when he was sent upon a six-months' trip to examine mines in Bolivia and Chile. So well did he think of his experience that he continued in the employ of the company and has been since connected with its operations in various countries and in different positions.

HENRY COFFIN CARLISLE

On his return from South America Mr. Carlisle remained at Tonopah for a short time and then spent a year at the Eden mine in the jungles of Nicaragua during its development period. The dramatic possibilities of a mining engineer's life are well illustrated by the next assignment, which brought Mr. Carlisle to the Mandy mine in the Hudson Bay region of Northern Manitoba, the farthest north of any mine in the mid-continent area. Thus he landed in January, 1916, direct from the tropics, and started for the Mandy by dog team in the prevailing winter weather of 40 to 50 deg. below. The mine had been discovered two months previous to the location of the Flin Flon mine in the same district. As will be recalled the Mandy was discovered by J. E. Spurr, who, when he was passing the outcrop in a canoe, told prospectors in another canoe where to prospect along the shore of Schist Lake. No one landed at the point at the time but the prospectors returned in a week and found the orebody. Mr. Carlisle had charge of the Mandy mine under Mr. Spurr during its operation and until it was shut down when the price of copper dropped in 1919. The conditions that confronted the company were unusual in that some 26,000 tons of high-grade copper ore was mined and hauled 40 miles on sleighs in the winter seasons and then by barges 125 miles to the nearest railroad point in the following summers. This required 250 teams, six tugboats and numerous barges as well as good management to get the ore out, but the operation was profitable as long as the price of copper remained high. From Northern Manitoba Mr. Carlisle returned to Nevada and assumed charge of the Nevada Wonder property during the last years of its operation. An extended examination trip in South America succeeded the work at Wonder. Since then he has been in charge of the western operations of his company. With the exception of the mining operations at Tonopah, most of his time is taken up in examination and development of new properties in various parts of the world. His headquarters are in San Francisco and his activities range from Mexico to Alaska.

Selection of a Stoping Method

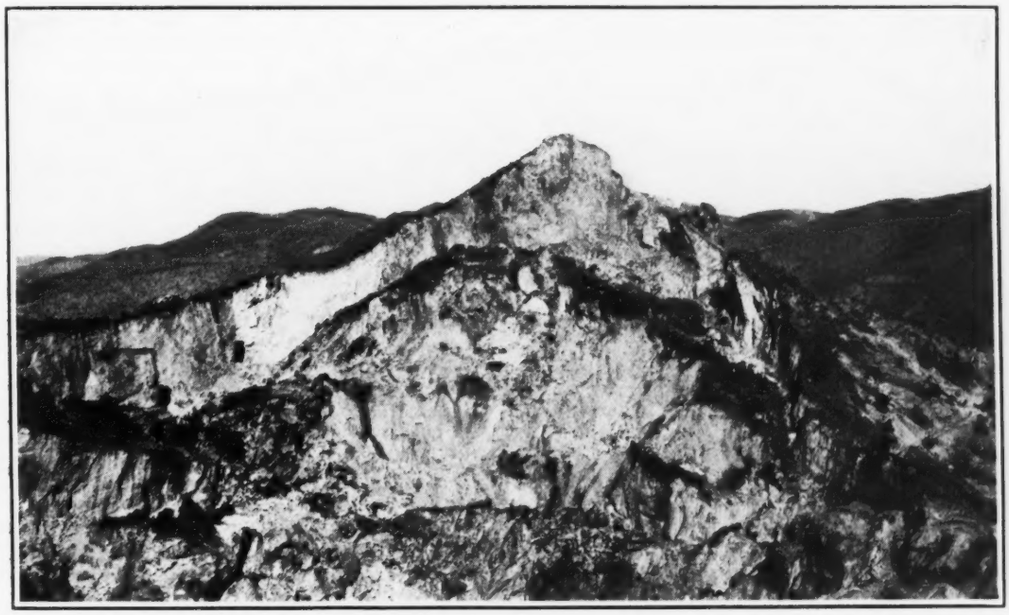
By CHARLES A. MITKE
Consulting Mining Engineer, Phoenix, Ariz.

THE ULTIMATE OBJECT of mining is profit. If, at the outset, it cannot be seen that such a result is likely to ensue, the work is not undertaken, and the orebody, at least for the time being, is considered "non-commercial." However, what is non-commercial one year may be commercial the next, partly owing to fluctuations in the market price of the metal, but largely as a result of the marked advance in mining and metallurgical processes, which are making possible the profitable mining of much lower-grade ores each year.

Increasing demand for metal, and low market values, have necessitated lower-cost mining methods and improved metallurgical processes, in order that the lower-grade ores may be mined and treated to keep up with the approaching exhaustion of the higher-grade deposits. Some thirty years ago nearly all metals were obtained from high-grade ores only. Today, a large percentage of all metals comes from low-grade ores, and production is many times greater than it was thirty years ago. "The largest lead producer in the country is now working ore that contains from 3½ to 4 per cent lead. The largest producer of copper in the United States is mining ore that averages 99/100ths of 1 per cent. Another important producer of copper, having a more difficult ore, is getting only 14.7 lb. of copper out of each ton.[1]" One extremely profitable gold enterprise which has been a dividend payer for nearly fifty years in 1926 mined 1,415,775 tons with a total gold content per ton of $4.10, from which it not only paid expenses but dividends besides. "Another well-known gold producer is mining ore underground that in 1924 ran only 87c. per ton in gold, and from which, in that year, it produced almost $2,000,000 (gross). If we want to step across the border, we find a silver producer whose work is typical of many other operations, who is working on ore containing only 5¼ oz. of silver per ton. All these are great achievements that not so many years ago would have been thought impossible. They are the result of the application of engineering and metallurgical skill in the development of mining methods and ore treatment processes that will lower costs."[2]

Ten years ago the mining at a profit, on a low market, of ore containing 7/10ths of 1 per cent copper would have been considered an impossibility, yet today it is an accomplished fact. Likewise, we find large tonnages of low-grade gold ore being mined at a profit both in the United States and Canada. Therefore, it is becoming increasingly difficult for the engineer today to draw a hard and fast line between "commercial" and "non-commercial" material. What may be non-commercial in one camp where only a small tonnage is available may be worked very profitably in another camp where large tonnages exist and large-scale operations can be introduced.

It would appear that within certain limitations tonnage is becoming increasingly more important than grade. This is indicated by the fact that many of our present large-tonnage producers would be failures if compelled to operate on a scale approximating 5 per cent or 10 per cent of their present daily production. Large-scale operations, and the liberal expenditure of sufficient money



An example of subsidence over caved stopes

[1] *Engineering and Mining Journal* editorial, (p. 163), July 31, 1926.

[2] From the same editorial.

at the start to insure the most economical operations, are the secret of their successes.

Some years ago, when copper ores ranging from 5 per cent and up were mined, and everything below that figure was discarded as non-commercial, it was merely a question of selecting from several well-known methods (which might be adaptable, and which, of course, would yield a good profit) *that system* which would best fit the character of the ground and give the highest recovery. However, since the exploitation of the low-grade porphyries, and the mining and treating of low-grade gold ores on a large scale, these ideas have been revolutionized, and it is now a question of finding a sufficiently low-cost stoping method which will come well within the narrow margin left, after the more or less fixed charges (such as treatment, selling, overhead, and others) have been deducted, and still leave a reasonable profit.

Today the constantly decreasing grade of the deposits now being considered affords only a limited choice of stoping methods, and presents, in each case, an individual problem, calling for the application of engineering ability, experience, and initiative, in welding together into one extremely low-cost mining method the best and most adaptable features of the present already low-cost systems.

Time Element and Metal Markets

The time and capital required to place a property on a paying basis must be taken into account. Sometimes the investment of a larger capital and a longer elapsed period before arriving at full production, with possible ultimate greater ore recovery, must be weighed against the use of a method requiring far less immediate outlay, and giving quicker returns but, possibly, a somewhat smaller total recovery. Here market fluctuations frequently enter into the consideration. Take as an example two mines which were in course of development some years ago. In both properties several methods were believed to be equally applicable. One of these, however, offered a possibility of a somewhat higher extraction than the rest, but required a much longer time for preliminary development. The first property selected this method, with its delayed preparation, and finally became ready for production at a time when many mines were closing down, as a result of a universal depression, and its first years of operation covered a long period of small demand and low market price, with a very narrow margin of profit. The second property selected one of the other methods, which required a much shorter time for preliminary development, but offered a slightly lower total recovery. Quick development, however, permitted production on a good market, and enabled this company not only to pay dividends, but also to pay back the larger part of the original capital within a comparatively short time.

Though the aim of all industry is stabilization, this has been only partly accomplished, and the governing factor, to a large extent, is still the fundamental law of supply and demand. As is well known, a slight overproduction is likely to result in a lowering of price, and a similar under-production generally has the opposite effect. Therefore, a mining method for a new orebody should be sufficiently flexible to meet the broad fluctuations in the market price of metals—gold, of course, excepted. "Flexibility of output without sacrifice of efficiency" is one of the important considerations.

Included in the cost of production are many things, such as the cost and character of labor available, the size of the orebody, and whether selective or wholesale stoping methods are applicable; distance from markets; climate; transportation facilities; character of treatment required, and whether mills and smelters are within convenient distance or must be erected on the property. Past performances in the vicinity, experience, and allowance for local conditions all have a bearing on the possible cost of production, and consequently on the ultimate success or failure of the proposed project.

"The economics of home treatment must be weighed against the sum which would need to be set aside for redemption of the plant, and unless there is a very distinct advantage to be had by the former, no risks should be taken. More engineers go wrong by the erection of treatment works where other treatment facilities are available than do so by continuing shipping. There are many mines where the cost of equipment could never be returned, and which would be valueless unless the ore could be shipped."[3]

The question might also be raised—if the decision has been made to treat the ore at the place of production—"at what point in the development of a mining project should treatment works be erected?" Last year a fairly expensive mill was constructed at a prospect having only four months' ore supply developed. Fortunately, when sinking was resumed, shortly before the completion of the mill, additional ore was developed in the lower levels, having approximately the same grade and composition as that in the upper part of the mine. Had there been a difference in the character of the deeper ore, rendering the mill unsuitable, or a considerable decrease in the grade, the property might have closed down, as funds were low. Instead of first blocking out anywhere from three to five years' ore reserves, the company erected a mill on a four months' supply, but luck stayed with it and the orebody below proved much larger than was originally expected, and the grade of the ore remained practically the same.

Various Phases of a Mining Project

The fundamental purpose of all mining is the discovery and extraction of mineral. Mineral-bearing ground that can be mined and treated at a profit is known as "commercial ore." In sizing up any deposit for possible production, the three important points to be born in mind are tonnage, grade, and costs.

Unless there is an assured tonnage of a proven grade, which can be extracted and treated at a profit, the deposit is not commercial at the moment. The tonnage, grade, and production cost may vary. If the tonnage is large, and wholesale extraction methods apply, a low mining cost can be obtained, and the grade of ore to be mined may, therefore, be comparatively low; whereas, if the tonnage is small and the extraction difficult (thus raising the mining cost), the grade must necessarily be sufficiently high to overcome these difficulties. In addition to permitting the extraction of ore at a profit, there must be sufficient margin to provide for a return of the capital invested in properties, plant and complementary equipment, within a reasonable time. This return is called an amortization fund, and the total amount is spread over the tonnage to be extracted during a certain definite period.

Every mine in its early stages was a prospect. All likely prospects deserve more or less development, in order to ascertain whether they will eventually become profitable mines, but, of these, it is said that only approximately one in eight hundred makes good.

[3] "Principles of Mining." By Herbert Hoover.

"Development is conducted for two purposes; first to search for ore; and, second, to open avenues for its extraction."[4]

The various operations connected with converting a likely prospect into a producing mine are as follows:

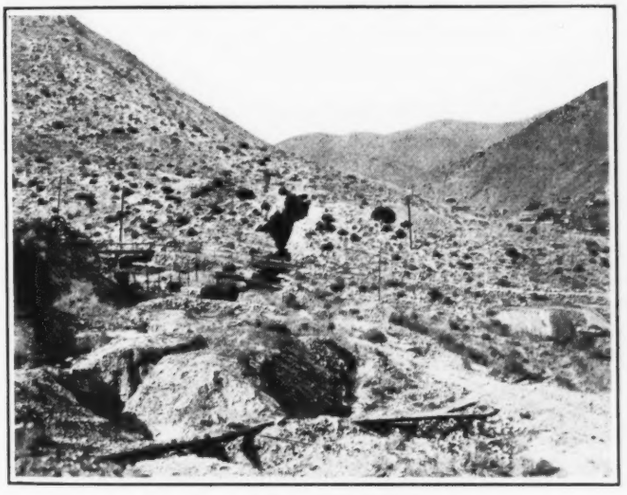
1. Prospecting and exploration in mineral-bearing ground, to locate orebodies and prove the existence of a substantial tonnage.
2. Estimation of ore reserves and determination of values, upon which scale of operations may be based.
3. Method of attack—or, selection of a stoping method.
4. Execution of necessary work preparatory to beginning stoping operations.
5. Management of producing mine.

The first operation requires engineering and geological skill; the second, not only engineering sense but financial judgment; the third calls for a wide experience in mining under varying conditions; and the fourth and fifth demand efficiency in management.

Many considerations enter into a determination of "the method of attack."

Conditions Governing Choice of a Stoping Method

The success of a mining venture will often depend to a large extent upon the selection of a proper means of ore extraction, or *stoping method*. As F. W. Sperr states, "An improper choice leads to high mining costs,



Surface cracks over old filled square-set stopes

loss of orebodies, and often loss of life." "More than one mine manager has casually assumed that such and such a system of ore extraction would work out satisfactorily (perhaps the only method with which he was acquainted), only to face the fact later that the method is not adaptable to his conditions, and that perhaps large blocks of ore have been lost through getting irremediably mixed with sand or waste. Then it is necessary to adapt another method of stoping to an underground development that was intended for some other system; the changing of stoping methods at an operating mine resembling 'swapping horses while crossing a stream.'"[5]

The method selected must embody the principles of *safety efficiency*, and *economy*.

Safety of the men is of paramount importance. Any method selected should be a "safe" method. If it will not afford protection, it should be ruled out at once, regardless of cost.

[4] *Op. cit.*

[5] *Mining and Scientific Press*, Feb. 19, 1916, and April 7, 1917.

Efficiency must include flexibility of output, good working conditions, and elimination of wasted efforts on the part of the organization.

Economy calls for a reasonable outlay for original development works, and the lowest cost per ton consistent with good business principles. "Experienced management and good engineering are the most potent factors in establishing a reasonable balance in the money outgo and performance ratio, without which the full possibilities of an enterprise cannot be realized. The fact that a profit is being made from an enterprise does not signify that it is being managed and engineered to the best advantage. Nor, on the other hand, does the fact that a mine is operating at a loss signify that it could not be made to pay. There are instances where small but important changes have been made in operating procedure, with the result that profits have displaced losses. Other instances are known where changes in management have increased the profits in an already prosperous enterprise."[6]

In applying a stoping method to a particular orebody, apart from the general considerations entering into the cost of production, there are a great many important, but local, details which must be taken into account. These are:

Character of the deposit

Size.
Shape.
Dip.
Occurrence of ore and amount of waste mixed with it.
Can waste be sorted economically?
Condition of back and walls of orebody.

Character of the ore

Estimated value per ton.
Complete or partial extraction required?
Fire hazard.
Possibility of future stoping around mined-out areas.

Open-Pit or Underground Methods

Though there are conditions where open-pit or underground methods appear equally applicable to the same orebody, this is the exception rather than the rule, and, in general, after a preliminary survey, a competent engineer can readily tell whether the ore should be extracted by open-pit or underground methods. The ratio of capping to ore—that is, the amount of capping which must be removed for each ton of ore—is generally the economic factor which determines, at the outset, whether open-pit or underground mining shall be used.

Discussion of Applicability of Various Underground Methods

It is impossible to establish a hard and fast rule regarding the types of stoping methods applicable to high- and low-grade deposits. It cannot be said, for instance, that a high-cost filled method should always be used in a high-grade orebody, or that a low-cost, wholesale method applies only to low-grade ores. Take the case of the Butte mines. There, in medium and fairly low-grade ore the square-set-and-fill—which is a high-cost method—has its application, because the ground is such that practically all working places must be timbered during the process of extraction, and waste fill used so as not to disturb adjacent orebodies. On the other hand, at Kennecott, the United Verde Copper Co., and elsewhere,

[6] "The Working of Unstratified Mineral Deposits." By George J. Young.

low-cost shrinkage methods have been used to mine out very high-grade ore.

Though the grade of the ore is necessarily important in the selection of a stoping method, the character of the ore mass and condition of the walls of the deposit or vein are largely the determining factors in the selection of the method. The distribution of mineral through

Room-and-pillar stope. (*Courtesy of "The Explosives Engineer."*)

the ore mass will also determine whether selective or wholesale mining should be practiced. The latter gives a low extraction cost and large output, but requires a big investment and must accept dilution and possibly some loss of ore; whereas the former necessitates smaller-scale operations, but requires a smaller initial investment and results in a higher-grade product.

Where the deposit is low grade but large, and has considerable vertical height, with values fairly well disseminated through the mass, some form of branch raise caving may apply, always provided that the ore mass and surrounding walls and back crush and break readily when undercut. The cheapest extraction methods are, naturally, the caved stopes, because the nature of the rock is such that it breaks up, and the stopes require no fill, as the back caves and comes down following the ore extraction.

Shrinkage stoping has its application in the harder ores, which require a good deal of drilling and blasting; for example, in the hard nickel deposits at Sudbury. If shrinkage is applied to deposits of the vein type, the back and walls must be firm. However, where it is used in large, massive, disseminated deposits, which are also hard, the condition of the walls is not so important, because the ore supports itself in the form of pillars. In the massive deposits height is an essential to the success of the system; in the vein deposits a dip of at least 45 deg. is necessary in order that the ore may run by gravity.

In narrow vein deposits the country rock on either side generally acts as pillars to support the back, with occasional pillars across the vein from wall to wall, but in the wider veins and the massive deposits, if the ore is low grade, pillars are left as permanent supports, or, if the value warrants it, filling is placed in the stopes after extraction is completed, and the pillars are later reclaimed by some other method. Occasionally, even in hard ore, such as the Creighton mine, simultaneous pillar drawing is practiced along with shrinkage in the stopes.

The use of filled and timbered methods in lower grade orebodies is usually prohibitive from the standpoint of cost. Selection is therefore limited to the open stope and caving methods, unless surface subsidence must be avoided, as in the case of low-grade orebodies beneath valuable surface improvements, lakes, rivers, or where excessive water is developed in the upper levels. In such instances no wholesale caving method is applicable, and the exact conditions would have to be known before deciding upon an open-stope method.

In higher-grade deposits where, owing to the great irregularity of the ore occurrence (as for example, in many replacement deposits in limestone, schist, and granite), the ore cannot be blocked out in the beginning, but must be developed by stoping, some method should be selected which keeps the ground intact and permits of sorting, prospecting from stopes with intermediate drifts, and disposal of waste in stopes as fill. In such cases, square-set and cut-and-fill methods have their application, the former being used in soft ground, requiring a large amount of timber, and the latter in firmer ground, where only a small amount of timber is necessary.

Top-slicing, which costs less than square-setting, is well adapted to soft and medium ground of good grade. However, when applied to the deeper deposits of 1,000 to 2,500 ft., it is important to prove definitely that no orebodies exist between the top-slice stopes and surface; otherwise, this method greatly limits the prospecting area above it.

Pyrrhotite is generally found not to heat up during stoping operations when it is caved, but pyrite and chalcopyrite, on the contrary, frequently generate heat, especially when they occur in the granular form, and in numerous orebodies have taken fire through the natural process of stoping, which results in oxidation and friction, the latter being caused by ground movement. Naturally, if the orebody contains large amounts of pyrite and chalcopyrite, some method of stoping which will not increase the fire hazard should be selected.

Incline cut and fill, as a rule, costs less than horizontal cut and fill. In the former, the ore and waste runs by gravity, whereas in the latter, stoping operations being carried on the horizontal, all material must be moved by hand and shoveled. Where much sorting is necessary, and sand filling is employed, the horizontal method is preferable. Both are applicable to vein, or massive, deposits.

The fill methods are naturally the most expensive extraction processes, because they require what practically amounts to a double mining operation—that is to say, first, the mining of ore, and, second, the mining of waste to fill the cavity caused through extraction of the ore. Though part of the filling, in many cases, is taken from development headings, a large amount has to be mined on surface in open mill holes, and taken through chutes to the workings beneath.

Open-stope methods are somewhat more expensive than the caved-stope methods, as the rock is generally hard and requires more drilling, blasting, and powder. In small, confined areas, and in narrow veins, where the walls are strong and the pressure exerted by sides and back is limited to a minimum, the entire ore may be extracted and cavities left open. If, under similar conditions, the walls are weak, filling may be necessary, though the width of the ore mined may only be a few feet.

Where there is great horizontal extent to the ore, and considerable pressure from above, as much as 50 per cent of the ore may have to be left in pillars to support the capping. Where so much of the ore is left in pillars, naturally there is an excessive development cost per ton, and it would be well to weigh this against the cost of some other stoping method which might permit of more complete extraction.

Sometimes methods are condemned off hand, when the fault, as a rule, is not with the method but in its wrong application. For example, to apply an open-stope shrinkage method to an orebody requiring a fill system would be an error in judgment, as the results would soon prove unsatisfactory. Likewise, the application of a cut-and-fill method to ground requiring square-setting, with close filling, indicates a lack of familiarity with the ground.

Each orebody is accompanied by a certain set of conditions, most of which will influence the method of stoping to be adopted. Careful observation of these and a knowledge of the various stoping methods will enable a decision to be made as to the method which is most applicable under the existing circumstances.

A New Palladium Mineral

AT A recent meeting of the Chemical, Metallurgical and Mining Society of South Africa a note was read on a new mineral which has recently been found on the Farm Tweefontein, the property of Potgietersrust Platinum, Ltd.: this farm which has already produced notable specimens of sperrylite. The mineral, which was detected originally in panning, proved on analysis to contain palladium and antimony making up 97 per cent. Analysis of clean particles gave the following: Palladium, 70.4 per cent; antimony, 26.0; "insoluble," 1.4; and iron (as Fe_2O_3), 0.9.

The mineral is silvery white and the particles can easily be detected with the naked eye. In the concentrate the particles are of a darker steel-gray appearance. It is not attacked by hydrochloric acid and only slowly by nitric and sulphuric acid but is easily dissolved by aqua regia. Specific gravity determinations gave results averaging 9.5. Platinum and other metals of the platinum group are generally absent or when present are only in minute proportion. This is rather interesting in connection with the fact that the sperrylite crystals found in the same locality contain practically no palladium; thus platinum arsenide and palladium antimonide are found almost side by side, each in relatively pure state.

The mineral occurs, as small crystals, in "eyes" of pegmatite which are included in shear zones traversing the banded ironstone of the Pretoria series. The sperrylite crystals occur in gossan in the shear zones.

Chromium Plating in Germany

At the end of 1925, according to *Chemistry and Industry* (London), chromium plating was employed in only two works in Germany, but twenty-three new works were opened during 1926, most of which employed the "chromo-industrie" process, the remainder using the Liebreich process. Plating with chromium has been adopted on a large scale at Solingen for the production of cutlery, and the use of chromium-plated parts is spreading. The "chromo-industrie" process is said to work with a very small current density, and gives rise to but little free hydrogen. It forms a uniform, strong, and finely ground deposit.

Large Gain in English-Speaking Immigrants

MORE than 45 per cent, or nearly half, of the net gain in population in the United States through immigration since the 1924 restriction act went into effect, have been English-speaking immigrants, according to an analysis of immigration made by the National Industrial Conference Board. This is a nearly four times greater proportion of English-speaking immigration than before the war, when, for the fiscal years 1912-13-14, the English-speaking proportion of alien net gain in population constituted less than 12 per cent of the total.

In actual numbers fewer are coming from Great Britain and Ireland than before the war, the average number of arrivals for the years 1925-26-27 amounting to 52,154, against an average of 81,549 during 1912-13-14. This loss in English-speaking arrivals from Europe, however, is to a large extent offset by a considerable increase of immigration from Canada and Newfoundland, arrivals from these dominions averaging 93,567 a year during 1925-26-27, against 71,977 during 1912-13-14, of whom about two-thirds are of English-speaking races.

More than five-sixths of our total alien population growth during the last three fiscal years—that is, since the 1924 act went into effect—came from Great Britain, Ireland, Canada, Germany and Scandinavia. Mexico, however, is rapidly taking the place of Italy as the source of our greatest foreign-speaking immigration, our net gain in population from that country, the influx from which is subject to no quota restriction, constituting nearly one-fifth, or about 19 per cent, of the annual average net gain by immigration since 1924. Italian immigrants during the last year before the war made up more than one-fifth, or about 23 per cent, of the 1914 total net immigration.

The huge influx of Italian people noted before the war, the Conference Board points out, has in effect been turned into an exodus under the quota restriction. While a total of 32,846 Italian immigrants entered since 1924, 65,092 Italian aliens have left the United States since then.

German immigration to the United States has increased considerably since the war, and even since the 1924 restriction act went into effect has averaged 50 per cent more than during the three pre-war years, the annual average of German immigrants during 1925-26-27 being 48,334, against 32,617 during 1912-13-14. Scandinavian immigration under the 1924 quota act averages less than two-thirds of what it was in the pre-war years, amounting to 19,235 during the fiscal year 1926-27.

Mexican immigration has nearly trebled, the average influx for the three pre-war years being 15,348 against 47,261 since the 1924 act became effective. Mexican immigration during the last fiscal year amounted to 66,766 and comparatively few, less than 5 per cent on the average, return or otherwise leave the country.

Aliens of the following nationalities or races during the past fiscal year left the country in greater number than those of their respective nationality or race who entered: Bulgarians, Greek, Chinese, Japanese, Portuguese, Rumanians, Turks, and West Indians. Owing to the great increase of Italian immigration during the past year, made possible through the law permitting the families of naturalized citizens and Italian war veterans and their families to enter as non-quota immigrants, Italian entries for the first time since the quota act became law outnumbered departures, though by less than 700.

Single-Roll Crushers

By W. T. W. MILLER
Engineer in Charge, Crushing Machinery Department
Hadfields Limited, Sheffield, England

IT IS SOMETIMES FOUND that a jaw breaker or gyratory crusher is entirely unsuitable for dealing with material containing mud or clay. Some of the more friable ores become semi-plastic in wet weather, and some limestones, shales, and chalk stones decompose

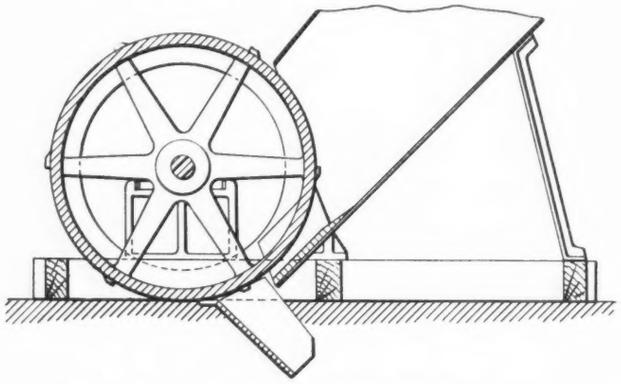


Fig. 1—An early type of single-roll crusher, patented in 1864 in Great Britain by A. Thomas

under snow, and, in this condition, become practically uncrushable in reciprocating breakers. The output from the plant may be cut down by half after a period of bad weather, and, not infrequently, the plastic material packs hard between the crushing faces or the slippery stones slide about until pressure is applied to force them downward. The single-roll crusher has proved to be extremely useful for dealing with materials which come within this category, and it is eminently suited for crushing the softer limestones, shales, gypsum rock, friable ores, and the like. Its field of service should, however, be limited to the crushing of substances which will not entail excessive strains on the framework or cause undue wear on the teeth of the roller. The machine consists of a toothed roll revolving in proximity to a breast plate which is so shaped as to give a gradually reducing aperture between the periphery of the roll and the face of the anvil plate.

Roller and breast mills have been used for many years for reducing grains, beans, and similar friable materials, and as long ago as 1864 attempts were made to apply the same principle to the crushing of stone. It is quite possible that earlier efforts were made to attain the same objective, but it is certain that, in 1864, A. Thomas obtained a British patent for the machine illustrated in Fig. 1, for the special purpose of crushing stone. The design was flimsy and the strength inadequate for the work for which the machine was intended, but in all the simple essentials this machine was the same as the modern crushers built for similar service. A roller of large diameter with projecting teeth was made to revolve toward the fixed inclined hopper plate, and the lower part of the breaker plate was hinged so that the outlet aperture could be adjusted as required. With the inferior materials then available and various crudities in the design the machine quickly sank into oblivion, but the idea was soon afterward developed in another form.

In 1867 Thomas Archer patented the crusher shown in Fig. 2, which consisted of a slowly moving roll turning inward toward an anvil block which was made to oscillate about a fixed center by means of a long lever and connecting rod actuated by an eccentric shaft. The lower part of the breast plate was adjusted by changing the length of the connecting rod, which was so constructed that packings could be inserted or removed between the blocks which separated the bearings. The roller was driven by gearing from a countershaft, which was connected by belt to an independent pulley on the crankshaft. In this machine the oscillatory movement of the breast plate was no doubt intended to do the crushing, and it is probable that the slow-moving roller was incorporated to gain the advantage of a constantly changing surface at the point where the work is concentrated. The rotary movement would also help to draw the material to the outlet. This crusher was really a combination of a roller and breast mill and a lever-type jaw breaker, and several contrivances of similar character and design were made by the same firm for a few years following the date of the original patent, but the mechanism was ultimately discarded for stone and ore crushing.

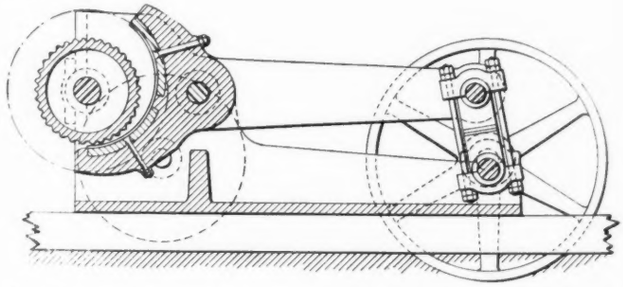


Fig. 2—Another early type of single-roll crusher patented in 1867 by Thomas Archer

In 1894 the McLanahan Stone Machine Co., of Hollidaysburg, Pa., built a single-roll crusher, with a roller 18 in. in diameter and 24 in. long working against a fixed breaker plate, for dealing with Florida phosphate rock, for which purpose jaw breakers had been found unsuitable. This machine proved so successful that others were soon afterward constructed, and a number were furnished for crushing friable iron ores and limestone. The McLanahan Stone Co. may fairly claim to be the first manufacturer to introduce this type of crusher for quarry work in the United States, and that company's initial success with the smaller machines created a demand for larger units capable of taking stones of considerable size and giving greater tonnage outputs. In a

few years' time the roll had increased to 36 in. diameter by 60 in. long.

All the early machines had fixed or semi-fixed anvil plates, as shown in Fig. 3, so that any adjustment in the

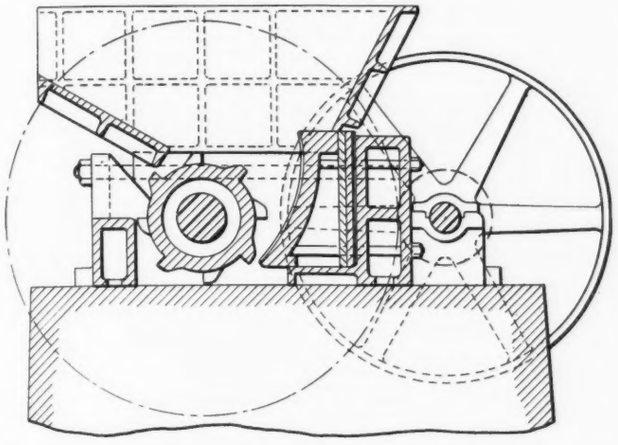


Fig. 3—All early single-roll crushers had fixed or semi-fixed anvil plates, as shown here. This type of construction offered considerable risk of damage from tramp iron

size of the finished product could be made only by introducing packings between the breaker plate and the back block. With this construction there is considerable risk of damage to the crusher should any unbreakable substance become wedged between the roll and the breaker plate. To give greater freedom for adjustment and to allow a safety device to be incorporated, the McLanahan Stone Co. developed a machine with a hinged anvil plate as shown in Fig. 4. Breaking blocks are inserted between the hinged plate and the crosspiece in the frame, and the lower part of the breaker plate is secured by strong bolts to the frame crossbar. These safety blocks are designed to give way under any unusual strain caused by, for example, a hammer head or other piece of metal.

The roller is usually made of chilled iron, with teeth or serrations arranged to suit the product required from the breaker. For light work this roll may be driven through two belt pulleys, one on either end of the shaft, but a single-reduction gear drive with the countershaft supported in the base of the machine is more customary. The wearing surface of the breaker plate is made with vertical corrugations when a coarse product is desired. Fig. 4 is a sectional view of a 36 in. x 60 in. crusher of this last-mentioned type, and the output of this machine, when set to crush fluxing stone to 6- to 8-in. size, is given as 350 tons per hour.

For a long time the frames of these crushers were made in cast iron, but it was found that the safety devices were not infallible and that occasionally a side frame would give way as the result of an accident. Three or four years ago frames of cast or fabricated steel were introduced to minimize the risk of failure and to insure continuous operation under the most dangerous conditions.

In the adaptation of these single-roll crushers for the breaking of coal a machine had been developed in which the hinged breaker plate was secured at its lower end by two long tiebolts passing underneath the roller in recesses in the side frames. These tiebolts were arranged in tension to pull the anvil plate toward the crushing roll, and safety springs were fitted underneath the nuts to provide some elasticity in the event of foreign matter entering the crushing cavity.

In another design, also used for machines for the crushing of coal, the hinged breaker plate is made with a bell-crank extension piece carrying cast-iron weights, the mass of metal being so disposed that the plate is pressed hard against stop pieces or adjustable packings to maintain the crushing aperture against all but abnormal pressures.

Fig. 5 shows in cross-section the "Fairmount" crusher as introduced by the Allis-Chalmers Manufacturing Co., which represents the single-roll crusher in its most highly developed form. Two machines of this pattern, with rolls 36 in. diameter by 60 in. long, were installed at Fairmount, Ill., for the Casparis Stone Co., about 1911. They were used for reducing fluxing limestone from steam-shovel feed to a size approximately eight inches and under. The framework of each crusher was made of two cast-iron side pieces of heavy box section in which were incorporated the bearings for the roller and countershaft and the pivot bearings for the hinged anvil plate or jaw stock. The tensile strains on the side frames, caused by the crushing of the large pieces of rock, were taken by two upper tension bolts which tied the pivot bearings to the main bearings for the roll shaft. In this crusher the lower end of the breaker plate was supported on a crossbar secured by two pairs of diagonal tiebolts which passed through the internal cavities in the frame castings and were continued through double washer plates inclosing nests of powerful spiral springs, which were introduced as a measure of safety against accident that might be caused by a piece of steel or other uncrushable material passing between the roll and the anvil plate. In its earliest form the roll surface was divided into segmental plates with square-faced teeth or corrugations, which were attached to the center by screws, but considerable difficulty was experienced in holding the plates securely and the design was changed at a later date. The Allis-Chalmers company developed these machines in two strengths, a lighter type for dealing with thinly stratified

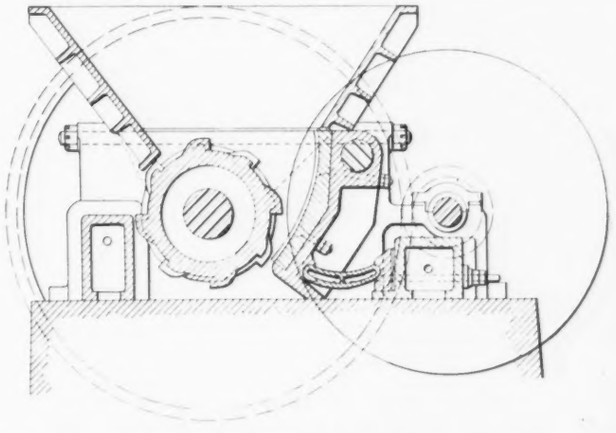


Fig. 4—A single-roll crusher with a hinged anvil plate, such as shown here, was developed by the McLanahan Stone Machine Co. to give greater freedom of adjustment and to permit use of a safety device

rocks and a more massive construction to handle the denser limestones.

The illustration Fig. 5 represents a machine, with a roll 60 in. in diameter by 84 in. long, supplied to the

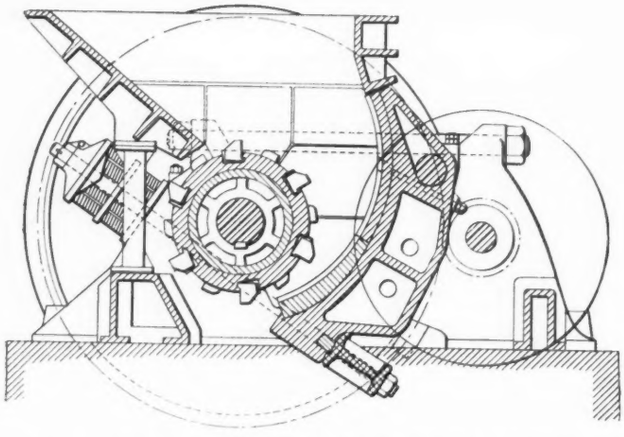


Fig. 5—A cross section of Allis-Chalmers' Fairmount single-roll crusher, a highly developed type

Michigan Alkali Co. about 1916. The roll was built up of a cast-iron center to which was keyed a cast-steel shell with inserted teeth of manganese steel. The crusher weighed 225 tons and was belt-driven by a 250 b.hp. motor to give a speed of 23 r.p.m. to the crushing roll. The feed size reached a maximum of 4x7 ft., and the crusher gave an output of 700 tons per hour when adjusted for a 7-in. product.

Single-roll crushers should never be fed with stones which are too thick to be gripped by the large teeth; the large pieces riding on top of the teeth grind the teeth away rapidly. The machine is entirely unsuited for crushing granite, trap rock, and other tough and abrasive materials, but in its own particular sphere it is more effective than any other type of breaker.

A cursory examination of the mechanism would lead to the opinion that the squeezing and tearing action of the roll against the anvil plate must make a high proportion of fine material. In practice, however, such is not the fact, as it is found that the single-roll crushers make less fines than either jaw or gyratory breakers when working on stone of the same grade. In part this is attributable to the selective action of the roll which crushes the smaller pieces first and then breaks the larger lumps by a process of gradual reduction. The downward turning effect also helps to maintain the steady passage of the material to the outlet, so that it moves quickly out of the crushing zone, avoiding pulverization. One great advantage possessed by this crusher is its positive self-feeding motion. The irregular projections on the surface of the roll keep the burden of stone well agitated and so prevent choking at the feed point. The thickness of the largest blocks fed to the machine should not exceed two-thirds the diameter of the roll, and the length may be almost equal to that of the roller. In this machine the hopper opening is large and unobstructed and, on stone which is friable and capable of being shattered by the "slugger" teeth, slabs of considerable area may be dealt with satisfactorily, but there is danger that they may ride about and hinder the flow of the stone, and it is somewhat risky to clear the crusher without stopping the roll.

The power diagram for the single-roll crusher consists of a series of fluctuations from normal to high load, the maximum figure being reached when the "slugger" teeth grip a large stone. The circumferential speed of the roll is approximately 350 to 400 ft. per minute, which is about one-tenth that of the giant rolls, and the kinetic energy is therefore of little service in smoothing down peak loads. Nevertheless, the fluctuations are not so severe, and neither are the overloads of such long duration, as with the high-speed rolls, and the shock load will rarely exceed twice the mean figure.

As previously stated, the single-roll crusher is particularly effective for dealing with rocks coated or mixed with clay or substances which decompose under the weather, and, so long as the material is not stronger than a moderately hard limestone and does not contain a high percentage of silica, a machine of this type possesses great advantages over other crushers in this field of operations. It is necessary, however, to emphasize the fact that great discretion and sound judgment are to be observed when the nature of the operation encroaches on the border line of the sphere of usefulness delimited above.

A Mine Upside Down

AT POTRERILLOS, according to a recent issue of *Chile,* the Andes Copper Mining Co. has a large low-grade deposit of copper ore, the mining and treatment of which should soon be yielding a considerable amount of copper. The dimensions of the deposit, as developed, approximate 4,900 ft. in length by 2,500 ft. in maximum width, with a maximum depth of 950 ft. and an average depth of 274 ft. It is estimated to contain 137,000,000 tons of ore having an average copper content of 1.51 per cent. The deposit consists of two classes of ore—oxide ore to the amount of 48,000,000 tons with a copper content of 1.54 per cent, and sulphide ore amounting to 89,000,000 tons assaying 1.49 per cent copper.

Potrerillos is situated on the western slope of the Andes range, about 92 miles east of the seaport of Chañaral and 200 miles or so south of Chuquicamata. The altitude at Potrerillos approximates 10,000 ft., the climate being excellent and free from extreme temperatures. Occasional rain and snow falls in winter, but the precipitation is so small as to be practically negligible.

Early in 1925 work was started on plant construction and on preparation of the mine for ore extraction. This work has been progressing at an increasing rate of speed for the last two years, and by the beginning of 1927 production of copper began.

Geology of the Deposit

The ore deposit lies in a shear zone of a mass of coarse-grained porphyritic rock which intrudes comparatively thin-bedded sedimentary rocks. This shear zone is enriched by veinlets and disseminated particles of copper minerals. The occurrence of the two types of ore is of such a nature that there is practically no mixture of the two, and each may be extracted separately as required. The character of the deposit, and the topography of the district, permit the application of a mining method that will result in a low cost. This method consists of driving levels and raises immediately under the ore, caving it, and ultimately allowing it to gravitate to underground storage bins, from which it will be loaded onto the cars of the railroad connecting the mine with the treat-

ment plant. These bins are situated at the inner end of an adit level which is at an elevation well below that of the developed ore. The distance between these bins and the receiving bins at the treatment plant is 5.7 miles, and of this distance the adit accounts for 2.31 miles. Ore cars of 40 tons' capacity each will be drawn in trains of 24 cars, by electrically driven locomotives powered through the medium of a third rail.

Metallurgical Process

The metallurgical plant now approaching completion is for the treatment of sulphide ore, and has a rated capacity of 12,500 tons of ore per day. At this rate of treatment the sulphide ore will yield approximately 117,000,000 lb. of copper per annum. Construction of the plant for the treatment of oxide ore should be completed by the end of 1928, and this plant will have a rated capacity of 7,500 tons of ore per day, at which rate the oxide ore should yield approximately 73,000,000 lb. of copper per annum. Thus by 1929 the aggregate copper output of the property should be at the rate of 190,000,000 lb. annually.

The sulphide ore will be subjected to flotation-concentration, followed by smelting and converting. These operations will yield blister copper, which will be shipped to the United States for refining. The oxide ore will be leached by sulphuric acid, and the resulting cupriferous solutions, after being freed from harmful impurities, will be electrolyzed, yielding cathode copper, which will be melted, refined, and cast into merchantable shapes. This copper will need no further refining and will go directly from Potrerillos to market.

Five Gyratories in Primary Crushing Plant

Arrangements provide that the sulphide ore will be dumped from the mine-mill railroad cars into three of the five cylindrical bins situated at the head of the primary crushing plant. The other two bins will receive oxide ore. In the primary crushing plant are five gyratory crushers which will crush the ore to approximately $3\frac{1}{2}$-in. size. Three of these crushers will be devoted to sulphide ore and two to oxide ore.

The sulphide ore will be conveyed by belt conveyors, from the primary crushers to the sulphide fine-crushing plant, which contains ten vertical disk crushers. These machines will crush the ore to approximately 2-in. size, and it will then be conveyed by belt-conveyors to the concentrator receiving bins. The concentrator consists of twenty sections, or units, each unit containing one ball mill, one drag classifier, and a series of pneumatic flotation cells. The ore will be fed to the ball mills, in which it will be ground to a fine sand in the presence of water and a small amount of flotation reagents. From the ball mills the pulp will pass to the classifiers, the overflow from which will pass to the flotation cells. In these the sulphide mineral particles will be concentrated and extracted from the pulp. The concentrates will be pumped to four 100-ft. diameter thickening tanks and the tailing will gravitate to a 200-ft. diameter, de-watering tank, thence to a dump formed by impounding them in an area suitable for that purpose.

Filtering Plant Operations

From the thickening tanks the concentrates will be passed to a four-unit filtering plant, where their moisture content will be reduced to 12 or 14 per cent. At this plant an amount of fluxing material sufficient for a proper smelting mixture will be added to the concentrates, and from there the mixture will be conveyed to a roasting plant equipped with six furnaces. The calcines from this plant will be transported in cars to the reverberatory smelting plant, which contains three 115-ft. by 21-ft. furnaces. Matte from these furnaces, containing about 40 per cent copper, will be tapped into ladles and then transported by means of a crane to basic-lined converters, of which there are three, and in these the matte will be converted into blister copper. From the converters the blister copper will be sent to a two-unit casting plant, where the material will be cast into blister copper cakes for export to the United States.

Oxide ore will be delivered by the mine-mill railroad to two units of the coarse-crushing plant. The product of these units will be conveyed to an oxide fine-crushing plant, which will crush the ore to approximately $\frac{3}{8}$-in. size. On leaving this plant the ore will be wetted and then mechanically charged into a series of concrete leaching tanks. There will be nine of these tanks, each having a capacity of 7,500 tons of ore, and they will be lined with a protective coating of acid-resisting material. In the tanks the ore will be subjected to counter-current leaching by sulphuric acid solutions, which will dissolve the copper minerals. After solution of the copper is completed and the enriched solutions have been pumped to a purification plant, the ore will be subjected to a series of washings to recover the maximum amount of copper. On completion of washing, the leached material in the tanks will be removed by means of a clamshell excavator and sent to tailings dump. The cycle of operations in the leaching plant will be such that on each day one tank will be charged with 7,500 tons of ore, and one tank will be discharged.

At the purification plant the cupriferous solution will have removed from it materials that are prejudicial to efficient precipitation of the copper. Then the solution will pass to the precipitation plant and be subjected to electrolysis, in process of which copper will be recovered in the form of cathodes and the spent electrolyte will be used as an acid solution for leaching. The copper cathodes will be transported to a furnace, in which they will be melted and refined and cast into commercial shapes.

Water Brought 32 Miles

Water for plant operation is obtained from the La Ola River, and is brought to the plant through a steel pipe line 36 in. in diameter and 32 miles long. The gradient of the pipe line is such that at a point 22 miles from the intake the flow of water is used incidentally for the operation of a 2,000-kw. hydro-electric power plant. By reason of a high salt content, the La Ola water is unfitted for use as potable water or for steam generation; hence water for these purposes is obtained from development of the seepages occurring in numerous quebradas in the vicinity of Potrerillos.

An appreciable amount of power will be obtained from boilers operated as adjuncts to the reverberatory furnaces in the smelter, heat being reclaimed from the hot gases in their course from the furnaces to the stack. Also, as mentioned above, some power will be obtained in the operation of the La Ola pipe line, but the main power plant is situated at the port of Barquito. This plant contains four 7,500-kw. steam turbo-generators, with the necessary boiler equipment. The power is transmitted at 88,000 volts over a two-circuit steel-towered transmission line to Potrerillos, where it is transformed to suitable voltages and distributed to the plant and mine.

Canadian Crystalline Graphite

AND

The World's Market

By H. P. H. Brumell
Mining Engineer, Buckingham, Quebec, Canada

THE MARKET for flake graphite was seriously dislocated after the war, and it is only now approaching normalcy. Many phases of the business have changed and an almost entirely new orientation has become necessary. The adoption of the electric furnace for melting metals reduced the demand for crucible-making graphite, though the use of graphite as a lubricant has grown so as to more than make up for the deficiency. Also, the demand for dry batteries has increased greatly, and as it has been demonstrated that natural graphite, when properly prepared, is superior to the artificial product, which in the past has controlled the market, the future for the natural product is bright. The demand for graphite as a paint stock has also increased, so that it is practically what it was in pre-war days, though the proportions used in the various trades have changed.

OF THE non-metallic minerals that were required for war purposes, probably none were of greater importance than the crystalline variety of graphite so essential in making crucibles. When consideration is given to the enormous tonnage of steel consumed in making shells, and it is realized that all this was crucible steel, some idea of the quantity of crucible graphite required is possible. With the exception of a small tonnage from Alabama, Pennsylvania, and Canada, the only sources of supply were the British island of Ceylon and the French island of Madagascar. The British and French governments placed embargoes upon the export of the material so that none of it might reach the Central Powers, and prices soared, as high as 30c. per pound being paid. The uncertainty as to a continuous supply and the existence of heavy contracts forced the United States and British crucible makers to pile up heavy stocks at the same time that stocks were accumulating in Ceylon and Madagascar. The result was that when the armistice was declared there were large quantities of crucible graphite in the United States, at London and Marseilles, and in Ceylon and Madagascar. It was only during the early part of 1926 that the last of these stocks was liquidated and the ordinary business of mining was resumed.

GRAPHITE occurs in Canada in both forms, crystalline and amorphous, the latter being widely distributed, of little importance, and occurring usually as graphitic shales, in no way comparable to the amorphous graphites of Mexico, Chosen, Italy, or Central Europe. Great importance, however, is attached to the numerous extensive deposits of high-percentage disseminated ore in the Archæan rocks of Ontario and Quebec. It may be taken as an axiom that crystalline graphite occurs only in crystalline rocks, and there is, in Canada, probably the greatest development of these rocks in the world, covering, as they do, the greater part of the provinces of Quebec and Ontario as well as a considerable part of northern Manitoba. In Ontario and Quebec are several well-developed fields, notably in Labelle and Argenteuil counties, Quebec, and in Lanark and Renfrew counties. in Ontario.

In Quebec, in the townships of Buckingham, Lochaber, and Boyer, Labelle County, in the Grenville series of the Laurential system of rocks, are numerous bands of graphite gneisses and limestones carrying from 7 to 8 per cent to as high as 25 per cent of flake graphite, the average on the developed properties being from 10 to 15 per cent. Enormous quantities of this ore are available. After many years of untiring research, and at considerable expense, a system of concentration has been developed, using oil-frothing flotation, whereby a recovery of about 95 per cent of the graphite content of the ore is made, the finished stocks assaying as high as 98 per cent pure. The flake produced enters the crucible market and is eagerly sought by buyers both in the United States and in Europe. Three grades of finished stocks are being made: No. 1, assaying from 92 to 95 per cent, coarser than 60 mesh and used for crucible making: No. 2, assaying from 88 to 90 per cent, and No. 3, assaying from 85 to 90 per cent. As one of the most important uses to which graphite is put is that of crucible making, it may not be amiss to publish the following assays of ordinary commercial crucible stocks to illustrate the superiority of the product of this province. The assay of the Quebec stock was made by A. E. Tucker, Birmingham, England, those of the others at the Pittsburgh station of the U. S. Bureau of Mines (U. S. Bureau of Mines Bulletin 112, 1920).

Table I—Assays of Five Graphite Stocks

	Alabama	New York	Pennsylvania	Ceylon	Quebec
Volatile C	1.89	1.30	1.53	1.68	.....
Graphitic C	87.03	88.97	88.80	85.06	93.87
Fe_2O_3	.38	1.08	1.75	1.61	1.35
Ash	10.52	8.64	7.96	11.64	5.38

As the questions of weight for bulk and of heat resistance are of importance to the crucible maker, it may be stated that the Quebec graphite has a specific gravity of 2.268 with a refractory value of 1.007, compared with

Ceylon, with a gravity of 2.250 and a refractory value of 1.004.

IN ONTARIO are several deposits of disseminated ore with content and mode of occurrence similar to those of Quebec, and, in addition, there is the well-known deposit near Calabogie, in Renfrew County. This deposit, owned and operated by the Black Donald Graphite Co., is unique in the character of the ore and mode of occurrence and is the largest and richest known deposit of graphite in North America, and probably in the world, carrying an average graphite content of about 65 per cent. The ore consists of massive graphite, of which about 20 per cent is refined into flake products, the remainder going into the foundry-facing, stove-polish, and other markets requiring ground stocks. The flake products go almost entirely into the lubricating market and the finished grades are probably the highest ever produced. No. 1 grade is coarse flake, assays 98/99 per cent pure, and is wonderfully soft and lubricous: No. 2, medium flake, averages 97.5 per cent; No. 3, fine flake, averages 95.5 per cent; and the other, ground, stocks assay from 74 to 92 per cent.

Table II—World's Production of Graphite

Year	Crystalline, Tons	Amorphous, Tons	Artificial, Tons	Total Tons
1919	17,267	120,227	4,082	141,576
1920	35,004	103,226	3,700	141,930
1921	15,424	81,755	2,944	100,123
1922	21,538	95,292	6,516	123,346

During last year there were persistent rumors of a merger of certain Ceylon and Madagascar interests, the negotiations being conducted by New York and London operators who were trying, as well, to secure control of some of the more important Canadian properties. With control of the output of Ceylon and Madagascar and of Canada it would be possible to boost the price of crystalline graphite, which has not been proving very profitable to operators in the foreign fields. A brief survey of the possible sources of supply will demonstrate the fact that Canada stands well to the fore and that, with proper organization and careful management, an extensive industry could be built up which, if kept independent, would do much to control prices.

CEYLON has been providing the bulk of the world's crystalline graphite from about 1830, since when the island has exported upward of 1,200,000 tons, with a value of over $95,000,000. Exhaustion of many of the larger deposits, coupled with increased cost of labor and the greater depth at which the ore must be won, has made the industry less profitable than heretofore. It has been stated by one of the principal producers that the present cost of production of all grades, at seaboard, is approximately $90 per ton, which, at the average quoted prices, does not leave much of a spread to cover freights, commissions, and other charges. Madagascar has extensive deposits of disseminated ore (lateritic) averaging about 7 per cent in graphite (E. A. Weldon, U. S. Trade Information Bulletin 163, 1923), but the labor and other conditions at present prevailing on the island are not all that might be desired. However, there are, apparently, enormous quantities of ore, and there can be no doubt that, as the industry becomes stabilized, costs will be reduced and a large supply of cheap flake afforded. Though price is, of course, a consideration with the crucible maker, it is not as important as that the graphite should stand up to its requirements and that the stocks should be uniform. It is of interest to note that, in 1922, an official commission was created under the supervision of the French government to control, as far as possible, the quality of the Madagascar graphite marketed. This commission determined that Standard No. 1 Madagascar graphite should not contain over 13.5 per cent of ash, so that crucible stock from Madagascar is required to contain only 86.5 per cent of graphitic carbon. The specification of the United States crucible makers calls for 90 per cent. A peculiarity of Madagascar graphite, in contradistinction to that of Ceylon, Canada, or Alabama, is that the particle appears to be "dry" and does not bond well with the clay, the "dough" being "short" or lacking in toughness and cohesion. As a lubricant, Madagascar graphite is not comparable to that of Ceylon, Canada, or New York.

Outside of Canada and the United States, and the foregoing two islands, the only fields where crucible, or lubricating flake, graphite could be produced at a profit are in Bavaria, where the flake is very small; and in Greenland, Spain, Norway, and Indo-China, with but slight probability of their operations being extensive, owing to the small extent of the fields as well as the inferior character of the material.

PRIOR to the late war, the world's production of natural graphite was about 135,000 tons per year, the average for the ten years preceding the war being 123,571 tons, of which 40,233 were crystalline and 83,338 amorphous, or classed as such. Since the war the world's production of crystalline graphite fell off materially, as is evidenced by the following tables, showing totals, only, for 1919-1922 and details for 1923-1925.

Table III—World's Production of Graphite by Countries

Crystalline	1923, Tons	1924, Tons	1925, Tons
Ceylon†	11,924	10,757	17,240
Madagascar†	11,845	12,712	15,397
Canada	1,113	1,334	2,626
United States	1,982	900	1,129
Total crystalline	26,864	25,703	36,392
Amorphous			
Austria	10,343	10,475	‡13,750
Chosen†	16,254	17,665	‡13,893
Czechoslovakia	10,869	13,129	‡14,410
France	209	.....	.....
Germany	22,941	11,987	‡13,200
Indo-China	.....	2,490	.....
Italy	6,260	2,514	10,010
Japan	881	846	‡935
Mexico	6,038	8,825	6,423
Union of South Africa	59	55	‡50
United States	4,056	4,071	3,536
Others	66	59	‡55
Total amorphous	77,967	77,216	76,262
Total crystalline	26,864	25,703	36,392
Total natural	104,831	102,919	112,654
Artificial graphite*	13,380	5,493	6,068
Total	118,211	108,412	118,722

*Powdered graphite only. †Exports. ‡Estimated.

In the accompanying tables, the artificial graphite referred to is the product of the United States only. A small quantity is made in Canada, and it is understood that a certain quantity is now being made in Germany.

With the exception of the crystalline products of Canada, Madagascar, and the United States, all natural graphites listed above are crude and require milling before entering into the various uses to which they are put. After milling, the stocks will have an average value of, at least, $100 per ton for the crystalline variety; $50 for the amorphous; and $60 for artificial.

THE ENTRANCE of artificial graphite into the market did not create the disturbance that had been anticipated, as it went almost entirely into the making of electrical articles. In later years and with the inven-

tion of radio there has been an increased demand for dry batteries, into the making of which most of the bulk or powdered artificial product enters. Artificial graphite has no inherent quality which would separate it from the natural product in the arts or put it in a class by itself. That it is used so extensively in the battery trade is, solely, by reason of its carbon content,

Table IV—Graphite Consumed in United States in 1924 and 1925

	1924, Tons	1925, Tons
Production, crystalline	900	1,129
Production, amorphous	4,071	3,536
Imports, crystalline	5,439	8,558
Imports, amorphous	10,936	9,210
Artificial, powdered	5,483	6,068
Totals	26,829	28,501

its size of particle, and its price. The same qualities are being obtained in the natural article, whose superiority has been proved in several ways, and it has become merely a matter of ordinary business as to which is bought and used.

Of the world's markets, the most important are those of the United States, Germany, and Great Britain, in the order named. The consumption of graphite in the United States during 1924 and 1925 was as given in Table IV.

The small quantity exported would not materially alter the figures of the table and has not been taken into consideration.

Table V—Graphite Imported in Great Britain in 1924 and 1925

	1924		1925	
	Tons	Value	Tons	Value
From Madagascar	5,218	.....	5,618	.....
From Ceylon	1,568	$678,600	2,469	$808,700
From elsewhere	7,771	388,550	8,930	446,500
Total	14,557	$1,067,150	17,017	$1,255,200

The imports into the United States during 1925 were 17,768 tons, valued, crude, at $826,410, or $46.51 per ton. For 1926, they were 16,194 tons, valued at $923,513, or $57.03 per ton, which seems to show that a greater percentage of high-grade, or crystalline, graphite was being imported.

The market in Great Britain is supplied entirely by imports as there is no domestic production. For 1924 and 1925, the imports were given in Table V.

As will be seen by the foregoing, there is a market immediately available to Canada in the United States and Great Britain of about 45,000 tons, the joint consumption of the two countries for 1924 and 1925 being 41,386 tons and 45,518 tons, respectively. In normal times, Germany has a consumption as great as or greater than the United States, so it is safe to say that, in the three countries, there is a market requiring, at least, 60,000 tons, of which 24,000 would be crystalline and 36,000 tons amorphous and artificial, the value being about $4,200,000.

THE Canadian graphite industry has not yet reached any great size, the principal reason being, until quite recently, the lack of proper method of refining, which was not achieved until the invention and adoption of oil-frothing flotation. This method of separation was applied to graphite only during the latter years of the war, after which, as there was only little demand for the product and as prevailing prices were very low, there was no incentive to begin or continue operations. A steadily improving market has again brought interest into the business, and it is unofficially estimated that the production for 1927 will reach about 4,000 tons with a value of about $350,000. Production during the last five years, showing a healthy and material growth, was as follows: 1922, 597 tons; 1923, 1,113; 1924, 1,334; 1925, 2,569; and 1926, 2,592 tons.

In conclusion it may be stated that Canadian graphite has a bright future. A thoroughly proved milling process affords good recovery of high-grade stocks, assaying as high as 99 per cent. There is an abundance of comparatively high-percentage disseminated and massive ore; cheap electric power is available in all the fields; and there is a market, near at hand, requiring about 45,000 tons, or over ten times the estimated production for 1927. Canadian crystalline stocks can be laid down at New York or Pittsburgh, London, or Liverpool, Hamburg or Bremen, cheaper than those from any other source.

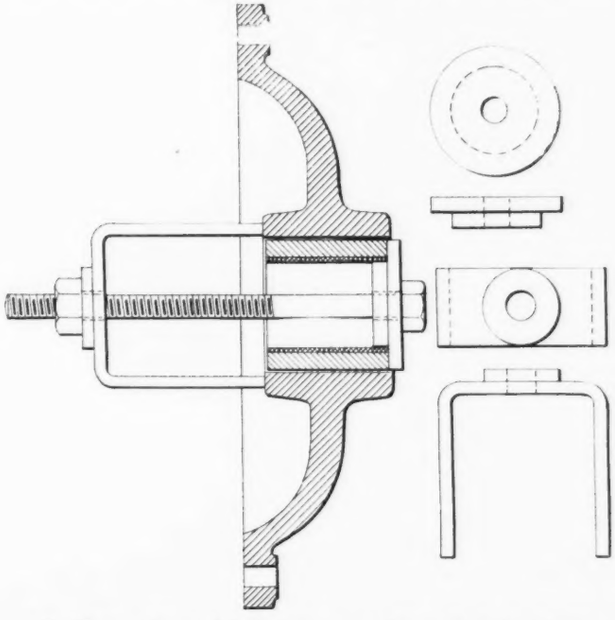
Skilled batea men in the Piranhas black diamond district of Brazil

USEFUL OPERATING IDEAS

How to Remove Motor Bearings

By Charles F. Beck

IN MANY MINES, mills, and smelters there are large motors in remote places, especially in mines that, from time to time, require replacement of bearings. As the larger motor bearings are from 15- to 20-ton fit, and even tighter, it is necessary to take the end bells to the machine shop so as to press out the old bearings and press in the new ones. This consumes a great amount of time, which can, however, be eliminated by using a puller similar to the one that I have shown in accompanying sketch. It is only necessary to remove the end bells. By using another washer and removing the yoke the new bearings can be placed in position in a few minutes by using the same bolt.

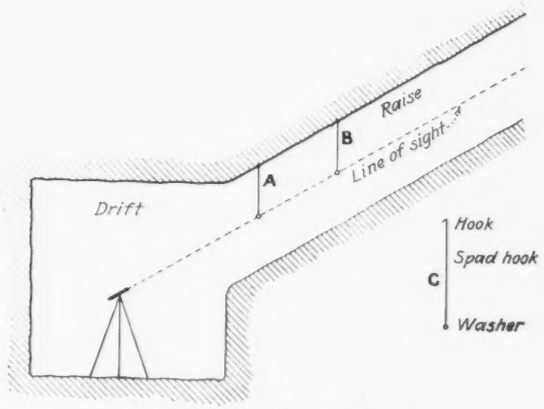


Pulling yoke and bolt for removing motor bearings

Alignment of Raises

By Hiram Smith

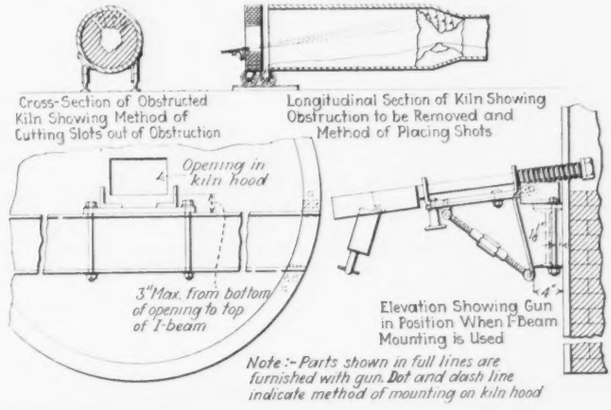
NOTING in Useful Operating Ideas methods for the alignment of raises, I offer the following method used in the anthracite region of Pennsylvania: Raises are called "planes" in the anthracite region and are maintained in alignment by sighting along a bearing line established by two spads driven in the roof as represented at *A* and *B* in the accompanying illustration. For establishing the inclination, "spad hooks" as shown at *C* are used. These are made of heavy iron wire $\frac{3}{16}$ in. in diameter. A $\frac{1}{2}$-in. washer is welded upon one end and the other end is tapered to a point and bent into the shape of a hook small enough to pass through the eye of the spad. Before drilling each cut, the miner takes a sight through the two washers, and is thus enabled to keep the raise on its proper grade. The hooks are removed and hung in a safe place when not in use.



A quick method of aligning raises

Removing Clinker Rings

IN A RECENT NUMBER of *The Hercules Mixer* appears the description of a gun used for the purpose of shooting out clinker rings that sometimes form in the revolving cement kiln. Although applied in the cement industry, the idea may have possible application for other furnaces. The gun is mounted upon a special frame as shown in the accompanying figure. It consists of a 30-in. barrel, 8-gage, with solid breech block when in position for firing. Special ammunition is used for the purpose. The lead slug, which weighs three ounces, is made from an alloy designed to resist fragmentation upon impact. The gun is mounted upon the front of the kiln and a keyway shot out of the clinker ring. After the "keyway" is shot out the kiln is started, and a few revolutions are usually sufficient to cause the remaining portion of the clinker ring to fall out.


Cross-Section of Obstructed Kiln Showing Method of Cutting Slots out of Obstruction
Longitudinal Section of Kiln Showing Obstruction to be Removed and Method of Placing Shots
Opening in kiln hood
3" Max. from bottom of opening to top of I-beam
Elevation Showing Gun in Position When I-Beam Mounting is Used
Note:- Parts shown in full lines are furnished with gun. Dot and dash line indicate method of mounting on kiln hood

United Verde Shaft Guide Practice

By C. E. Mills

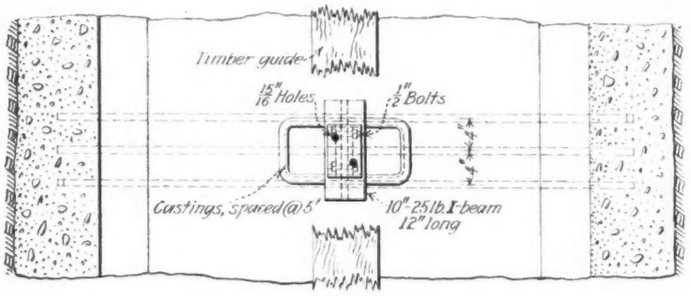
NO. 5 ORE SHAFT at the United Verde mine, Jerome, Ariz., was completed from the 800 to the 1,950 level in September, 1918. Oregon pine guides, 4 by 8 in. in section and 15 ft. in length, were installed. The guide-bolt sockets consisted of 10-in., 25-lb. I-beams with cast-iron hand-hole boxes to provide access to the nuts of the guide bolts. These are shown in the illustration in Fig. 1.

The guides were installed by using a plumb line and shimmed to line with oak shims. Possibly 5 per cent of these guides were replaced from time to time and gave good service until the early part of 1926, when they were so badly worn as to allow the skip roller to rub on the shaft walls. To effect temporary repairs until new guides could be ordered, wedge-shaped oak strips 3 in. in width were made up and fastened to the edge of the guide by means of $2\frac{1}{2}$-in. No. 16 wood screws. Because of the twist in the cable, practically all the wear is on one edge of the guide, and these strips were necessary on one side only. It was thought that the strips would splinter and would be cut by falling rock, but to date they have given one and a half years of service and are still in good condition.

The new wooden guides (Fig. 2) which will replace the present guides above the 1,800 level are $3\frac{5}{8}$ by 7 in. clear Oregon pine with a $3\frac{5}{8}$ by 1-in. clear oak wearing strip secured by means of flat-headed wood screws. This type of guide, with a wearing strip, has several advantages; the cost is about 40 per cent less than for oak guides; kiln-dried stock may be secured, whereas it is impossible to purchase kiln-dried maple or oak guides of uniform lengths in any quantity, and mill run is likely to warp and cause considerable trouble in aligning guides. In addition to this, the wearing strips may be replaced at small cost at any necessary time.

Spillage from five loading pockets averages 150 tons a month, and this amount of spillage quickly cuts the wooden guides in the lower section of the shaft. For this reason, steel guides were selected for the new portion of the shaft down to the 3,000 level. These guides consist of 8-in., 21.5-lb. ship channels, with the back out. Plates $\frac{3}{4}$ by 8 in. are welded to the flanges for fastening to the guide-bolt sockets. Fig. 3 shows a detail of the guides. The guide-bolt sockets are of cast steel and of slightly different design from those used in the upper section of the shaft. They were equally spaced by $\frac{1}{4}$ by 2-in. spacing rods, which were left in the concrete. Fig. 4 shows a detail of the socket, which weighs 36 lb. The guides were fastened with $\frac{7}{8}$-in. bolts, and oak and metal shims are used to bring the guides to the proper gage. The cost of the steel guides averaged $2 per foot in place and is much greater than for Oregon pine timber. Probably the additional cost is warranted only where conditions under which the guides are used are particularly severe.

It has been found that in spite of ordinary care in spacing guide-bolt sockets, variations will occur which cause serious delays in installing steel guides. After the shaft has been stripped, steel wire is stretched between levels, and the guide-bolt holes are measured from the center line horizontally and also vertically. This work is done by the engineers, and a drawing is made showing the position and spacing of all holes for each individual guide. These are numbered before being sent into the mine, and experience has shown that the additional work of detailing each guide separately effects an appreciable saving in the cost of installation.



Elevation of Wall

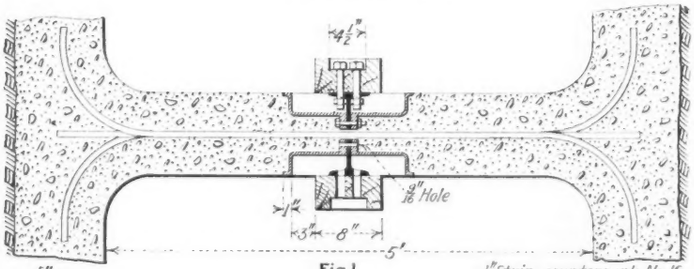


Fig. 1

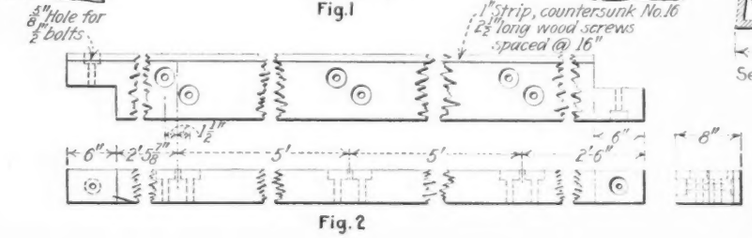


Fig. 2

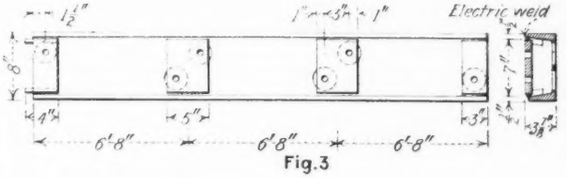


Fig. 3

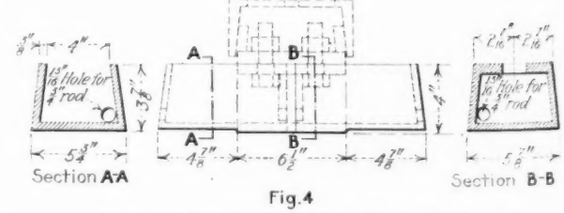


Fig. 4

Details of guides used in United Verde's No. 5 ore shaft

Fig. 1—Guide-bolt sockets used for screwing wooden guides. Fig. 2—Standard wooden guide. Fig. 3—Steel guide in detail. Fig. 4—Socket for fastening steel guide.

DISCUSSION

What Chance Has the Western Prospector?

THE EDITOR:

Sir—In your issue of Aug. 13 an editorial appears which is entitled "What Chance Has the Western Prospector?" It is an unquestionable fact that comparatively few new mines are being developed in the Western mining districts of the United States. Engineers in charge of exploration for operating companies agree that they have met with little success in this country, and say that they must look to the foreign fields for new mines.

The *Engineering and Mining Journal* shows a steadily increasing number of Canadian mining stocks. The appearance of a new name among the coppers is a rarity. The San Francisco Exchange quotations of Western mining stocks would be amusing if they were not indicative of the condition of the industry which they represent.

It would seem that the prosperous days of Western metal mining are over, at least until some fundamental change in conditions occurs. Certainly sufficient cause exists for the decline of the business of prospecting as it has been carried on in the past, for men cannot be expected to work at an occupation which does not offer a reasonable opportunity to make a living.

The prospector has not much chance in this field today. The country has been given a fairly intensive preliminary prospecting, sufficient to locate most of those deposits which have obvious outcrop indications, with ore at or near the grassroots. Veins may still be found which have had little or no work done on them because values do not show at the surface. But it is difficult to get assistance to do the initial work necessary to prove such veins, in spite of the talk of geologic prospecting, increased knowledge of outcrop indications, and so on.

As a specific instance of this, I recently became interested in a group of claims located and held by a prospector who had done such work as he could himself. The vein outcrop is easy to follow and shows definite traces of original sulphide ore minerals, now almost completely oxidized under conditions which suggest leaching of both gold and silver. Lead is still present as carbonate and oxide, with occasional residual particles of galena. Estimation of the proportion of sulphides originally in the vein material suggests a probability of ore of commercial grade and quantity being found at depth. There is also the possibility of secondary enrichment.

For a length of 400 ft. there is a strong outcrop, with widths of 12 to 20 ft. of quartz and mixed carbonate minerals, and some iron and manganese oxides. There are numerous cavities, or "casts," left by the alteration of the sulphides. The surface vein material is evidently not ore, but samples show the general existence of traces of gold, silver, and lead. The country rock is andesite porphyry, and there is a mass of rhyolite a short distance north and east of the outcrop which appears to be intrusive into the andesite.

So much for "geological prospecting." It has said all that it can say with the statement that geologic conditions are favorable; the vein is of a possibly productive type; there were originally present galena, pyrite, cupriferous pyrite, and gold probably with the pyrite. The leached part of the vein should not extend over 200 ft. in depth, and values should improve after the first 50 ft. from surface.

Now we have run out of theory, and it is a question of *digging,* because there is no other way to prove the existence of ore in the vein. What are the prospector's chances?

His problem is to sink a shaft at least 100 ft., preferably 200 ft., crosscut the vein, and if possible drift on it 200 ft. or more. He cannot get credit for powder, fuse, caps, and grub from the local merchants, since they say that sort of business no longer pays. His claim is 30 miles from the railroad, the nearest water is 3 miles away, and he has only an old Ford car. It will cost at least $2,000, not counting labor, to see if he has anything worth holding. He cannot interest local acquaintances in the prospect because there are no high-grade specimens to show and no good assays available. For obvious reasons promoters from the Coast cities are not interested. There is little "excitement" in the district, and they are looking for something about which a big talk can be made, their stock run up a few cents a share and unloaded on the public; from the promoter's standpoint, that is the way to make money in mining.

Maybe the Blank Smelting Co. will take over the claims, pay the prospector $100 a month for six months or a year, and a total of $10,000 in the next two years if developments are satisfactory. A short description is sent to the nearest office of the company outlining the facts as given above. It is clearly stated that there is no ore in sight, and that the prospect should be passed upon by an experienced geologist capable of judging leached outcrops. After a delay of several weeks a young engineer visits the property for the company, spends an hour or two looking over several claims, and asks where the ore is. He says that he is an ore buyer and that he has not seen any ore, also that the vein does not look good to him. He has scarcely looked at the vein, certainly not closely enough to decide as to the character of the sulphide casts and the proportion of the vein material they represent. He takes no samples, and is evidently one of those speedy "experts" who can size up such a situation at a glance. He goes away after a half day's examination which he spent two days of traveling to make, and the exploration department of the company has its record enriched by one more report.

The Old Original Mining Co. is operating in the state and it is rumored that it is looking for siliceous lead

ores. Its attention is called to the prospects, with a statement as to the size and character of the outcrop, distance from the railroad, etc., and the fact that with no ore in sight the probabilities are that the vein will develop concentrating ore with depth. The prospector is advised that the consulting engineer will visit the property. He comes, after several weeks' delay, and says that he is not familiar with deposits in volcanic formations, that the outcrop is not very big, and general conditions are unfavorable. He takes no samples, and says that a yellow powdery mineral which "hangs back" in the pan is not a lead mineral, but probably ochre. He goes away.

The following are quotations from his report:

"I have been unable to recommend advancing funds for the exploration of this property. The mineralization is meager and limited in size. It is 30 miles from a railway. Its recommendations are on strictly geological evidence.

"Although the croppings are well silicified and stand out boldly and we can find, by sampling, some lead, 2 to 11 per cent, with a little gold and silver, and occasional copper strains, there is no ore in sight.

"The shallow trenches in which samples were taken indicate a rather moderate width, 15 to 20 ft., and extend for about 400 ft. north and south. Still farther south the croppings can be traced for another 400 ft., but are much less important.

"To me the mineralization does not appear particularly strong, nor has the formation the appearance of size. Unless it is very rich or has considerable size, it would have little value with the present state of transportation. A 30-mile haul to the railway and further charges for freight and treatment would cut heavily into the profits of a direct smelting ore. A mill would require a good deal of ore to pay for its installation, and water is scarce. It is for these reasons that the prospect does not look attractive. I would have advised exploring the ground if it had been nearer a railway."

All the objections offered by this engineer must have been apparent from the original description of the property sent to the company's office. It could scarcely be expected that the outcrop would show greater size or value than had been represented.

From the standpoint of comparison with outcrops of other veins known to be productive in similar formations, this one offers a somewhat better than average showing, in my opinion. Certainly it would have had some work done on it had it been found near Tonopah, Goldfield, Randsburg, or in many of the Mexican districts.

It may as well be admitted that the prospector has little chance in Western mining at the present time. It is unlikely that he will discover a deposit favorably located with respect to transportation, power, and water, with sufficient ore at surface to make the enterprise pay its own way.

Several further efforts were made to obtain funds for the initial development of this claim, but they always stalled on the fact that there was no ore in sight. Somebody else must take the initial risk. Then how is it going to be possible to find new mines, if none of the people in the business will take prospecting chances, if outside capital cannot be enlisted for the work, and if conditions are such that the prospector unaided is unable to successfully do the first work required, which is naturally more extensive than in the early days?

Western mining districts are suffering from lack of initiative and capital necessary for continued growth and development. A few aggressive operators are still in the field, but only a few, and they cannot do it all. There is the well-worn argument that when the need for the metals becomes greater, prices will rise, and high prices will stimulate activity. That is doubtless true, but of little encouragement to the prospector of today.

Until there is a reversal of present policy in the matter of doing work on prospects, and abandonment of the idea that someone else must take the chances, while mining capital waits for mines with ore blocked out, there will be no big chance for the Western prospector, and no great advances in Western mining activity.

As a contrast, consider the reports from Canada. Mines are being developed in a region which for many years was considered unlikely to contain important deposits. That country is comparatively difficult to prospect, with many lakes and swamps, heavy vegetation, and thick mantle of soil or glacial drift, but money is evidently available on a scale that has been unknown in the Western United States for many years. Possibly it was to be expected that in California the wealth which came from the mines would go largely into the development of the state along other lines, instead of finding its way, in part, back to the mining field. The policy of California mine owners and operators in earlier times did not seem to consider the necessity of perpetuating their enterprises by carrying on adequate prospecting of new areas. The same condition has developed to a greater or less extent in others of the Western states where mining was the most important basic industry in the pioneer days, but not all of these states have been as fortunate as California in having the resources to develop other industries.

The Iron Country an Example

The Lake Superior mining region offers many examples of what may be accomplished by a different method of procedure; there new mines have been found through systematic exploration on an adequate scale. Thirty-five years ago in that district the original discoveries of outcropping iron ore had been quite thoroughly exploited, and many mines were supposed to be exhausted. Today there is probably more known iron ore in reserve in certain of the Michigan districts than was dreamed of in the early '90s. The stronger operating companies have spent large sums of money on exploration work instead of leaving the development of new mines to be carried on haphazardly by individuals.

The chance of the Western prospector will come when money is available for systematic prospecting under the pressure of urgent necessity to find new supplies of the metals; that may not be next year, nor within the next ten years. We may become so internationally-minded, as a nation, that we will range over all the further fields for those ore deposits which may be most easily found, and furnish capital for mining in foreign lands, to the neglect or conservation of our own resources.

But whenever the time does come that there is demand for increased production here in the West, the prospector will still be the pioneer. Conditions especially favor his practical activities; distances are great, the country is rugged and hard to traverse away from the desert plains, and a great amount of hard, patient work is necessary. On the other hand, in many of the districts, much may be seen at the start without cutting brush and digging trenches.

What the practical prospector needs at present more than anything else is a fair chance to make a profit commensurate with his expenditure of time and effort, when he has found something which requires more digging than he can do alone.

At the start he should be advanced enough money for

outfit and grub, and it should be made easy for him to check his work with the necessary tests and assays. As the cost of field operations increases he should be allowed a reasonable wage, and helped with such equipment as would enable him to go ahead to a decisive point. This could be done under a working agreement which would provide for the purchase of a major interest in his prospect at a price which would be fair to both the company rendering the assistance outlined and to the prospector, who would be entitled to something better than average wages for his time, and a small interest in the mine, should the prospect turn out to be a producer. Such a method of procedure would assure the gambling chance necessary to attract men to work of this sort.

It may be urged in objection that it would subsidize loafing; it would if loafers were employed, but it is no more necessary to employ loafers on such work than to hire them at a mine.

The writer has known many prospectors and miners who would work for wages and the chance to go prospecting, and the percentage of self-starting, go-getting hard workers among them is unusually high. With a dozen such men, proper field equipment, and an adequate working fund, it would be possible to do some real digging and find a new mine every now and then. J. H. FARRELL.

San Francisco.

The Comstock Then and Now

THE EDITOR:

Sir—I have just returned from a short visit to the Comstock lode, in Nevada, after an absence of fifty-eight years, and I am surprised and pained to see what a great change has taken place. When I left there, the mines and mills were busy, and everything was in a flourishing condition. Now the mines and mills are idle—not a mine or mill is being operated, and the end has come. Virginia City, that once had 20,000 inhabitants, has between 200 and 250 persons. Gold Hill, one mile distant, once had 15,000 people, and now has forty or fifty. The big stone and brick buildings are either falling down or are vacant, the daily newspapers have all quit and left, and people are leaving every day. It will be only a short time before these two towns will be added to the other ghost towns of Nevada. It was sad to see.

It seems to me that something can yet be done to help things in this great camp. From the Sierra Nevada mine on the Comstock ledge on the north end to the Caledonia mine on the south end of the workings of the lode is a distance of about 2½ miles. This includes the distance over which the lode has been worked, and a long string of waste dumps containing hundreds of millions of tons of rock taken from the numerous shafts along the lode. It is impossible to form any estimate of the amount of rock in these dumps. If some cheap process for extracting the gold and silver from these dumps could be found millions could be taken from them, that would keep the cities of Gold Hill and Virginia alive for several years.

When I first went to the Comstock in 1860, rock that paid less than $50 per ton could not be worked at a profit; now they tell me that by electricity and water power they have made rock pay at $6 per ton. I think the suggestion as to working these immense waste dumps is good, but I don't suppose it will be done in my day, as I am past eighty-three years old, but still in the ring.

Los Angeles. GEORGE A. DYSON.

By the Way

Doubtful Service to Investors

ADVICE given to investors who ask questions to be answered through the financial columns of many of the newspapers is usually worth about what it costs, which is a two-cent stamp, or maybe only a postal card. For example, the other day some one wrote to a Brooklyn paper asking "Can you tell me what is the basis of the rise in Teck-Hughes stock, which is now selling above $9 a share, after having been as low as $5 a share this year? Would you be disposed to sell it at present prices?" The financial adviser, who probably had never even heard of Teck-Hughes, though it is one of the great gold mines of the continent, replied: "The only reason for the rise that I know of is the reported find of rich copper-gold ores at great depth in the company's properties in the Kirkland Lake District. . . . Of course, the value of the stock may be affected extensively by this find, if it is as important as reported. That makes it highly speculative, and I cannot venture to predict what may happen. For this reason also I do not care to advise you on holding or selling." Evidently this authority has his big finds mixed up; what he refers to sounds more like a reference to the discoveries at Rouyn, though they can hardly be said to have been found at great depth. Certainly, there is no copper to amount to anything at Kirkland Lake. Why, by the way, is it always taken for granted by financial writers that even the very best mining stocks are highly speculative? Should a bad business depression come, it would seem that one's money might much better be in a high-grade gold mine than invested in many speculative industrials.

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Making a Better Magazine

WE ARE rather proud of our new habiliments, which we have now worn for several weeks; the new type and arrangement we believe makes for easier reading as well as being more attractive artistically. Several have commended us on the change, though no doubt many have merely thought that their *E.&M.J.* looked a little improved without knowing why. Some technical magazines, foolishly it seems to us, stick to the same old typographical make-up decade after decade, thereby suggesting that, so far as they know, no progress has been made in the printing art. An occasional change in typographical appearance stimulates one to progress in other ways, too—to make the magazine constantly more interesting and helpful in every way.

The publisher, though, is not entirely responsible for what is in his magazine. Technical publications, particularly, are only as good as the men in the field make them. If you are not entirely satisfied with your magazine, ask yourself what contributions you have made to its columns; for the technical magazine is fundamentally a forum for the interchange of information; a means of service to one's self and to one's fellow engineers. As bait, we do not use worms, but pay a modest amount for technical articles and photographs that we accept. The service that one can render in this way to his fellow worker is often not considered. The value of having one's name at the head of a good article is also frequently overlooked. Half one's ability is wasted if it is unappreciated outside of one's own bailiwick.

NEWS OF THE WEEK

Summary

REPRESENTATIVE group from the mining industry will appear before the Director of the Budget to point out some of the basic requirements of the industry in the hope that it may receive more attention from the Federal Government.

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Construction of a railway from The Pas, in Manitoba, Canada, to the Flin Flon mining territory is possible in the near future, according to Canadian National Railway officials.

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Mond Nickel Co. develops treatment process for South African platinum concentrates after considerable experimentation and study of the ore occurrences in South Africa.

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No change in the duty on manganese is at issue in connection with the investigation now being made by the U. S. Tariff Commission.

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Satisfactory development operations by the Treadwell-Yukon Co. in the Tybo section of Nevada are reported.

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Erection of the third steel mill in the Joplin-Miami district is planned by the Velie Mines Corporation for this fall.

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Another company, the Meteor Crater Exploration & Mining Co., is formed to locate the meteoritic body near Winslow, Ariz.

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Strike situation improves at the Amparo mine, in Jalisco, Mexico, with the arrival of a small picket of federal troops.

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U. S. Department of the Interior issues new instructions in an effort to expedite field examinations of mining claims.

Effect of Empire Mining Congress Already Evident in London

Canadian Resources a Much Discussed Topic—Public Looking for Ventures in Good Districts—Object to Brokers Reaping Profits on Funds Subscribed

By W. A. Doman
Special London Correspondent

ALREADY, it would appear, the Empire Mining Congress in Canada is beginning to bear fruit. No matter where one goes in mining circles Canadian resources are the topic. News agencies, and the government too, supply the journals here with descriptions of various working mines; also, pamphlets and circulars are available concerning the different mineral deposits. The country has been boomed by the references made to it by the Prince of Wales, and by Sir Robert Horne, so that it may be expected later that companies and syndicates will apply in the London market for working capital. The public is told that the resources are unlimited, and the performances of the Hollinger, the Dome, the McIntyre and the Teck-Hughes are frequently cited.

Previous Experience Recalled

London had its experience of the Hollinger in the early days when a block of shares was sold here in order to make a market. Apparently the people who had them thought it best to take a quick profit, with the result that the shares returned to Canada, where they have proved a good investment. The recommendation of them now does not seem to have much effect, for the public has not a great liking for a mine that has been in production for many years, and of which it has relatively little knowledge. Mining houses in Canada are sending their circulars to this side, drawing attention to different properties, and trying to interest capitalists here. It is frequently mentioned in the technical journals that mining engineers who have returned from expeditions to other countries have no sooner landed than they have re-embarked and set out for Canada. It is to be hoped that they will bring back sound propositions. The public will take them eagerly if they are good, because, apart from tin mines, little is offering at the moment that gives promise of substantial returns—at least in the share market—such as mining undertakings in the early stages frequently offer. One point of criticism of the Empire Congress is that the visitors to Canada are being shown the developed mines. These, being on an investment basis, offer relatively little attraction. What is looked for is some venture in a good mining district which can boast responsible backing.

Financial Methods Questioned

The British public, too, has to be educated up to the financial methods of Canadian promotion. It is not quite satisfied with the practice of a company selling a block of shares at a merely nominal price—a few cents a share, say—to a firm of brokers, and then being asked to pay a much higher figure to the firm. The company, says the public, does not get the benefit of the money subscribed; the brokers reap the profit. Stories are told that brokers often sell more shares than they have obtained from the company, and, when the time arrives for delivery, they depress the price in order to set matters right. Such procedure does not appeal to the British public. But given a straight deal, and assurance that the money subscribed will go into the mine, investors willing to take the risk will not be lacking.

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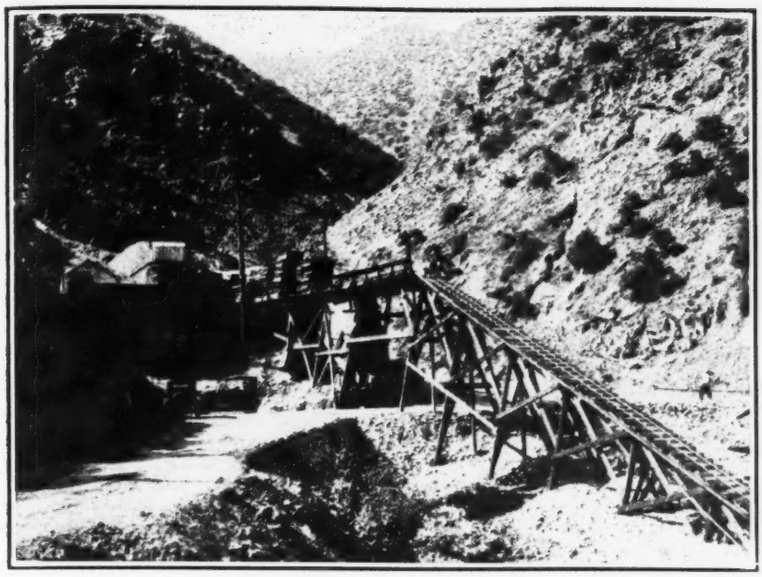
Development of New Orebody at Cananea Progressing

About a year has elapsed since a tunnel and shaft in Democrata Gulch were started by the Cananea Consolidated Copper Co. to explore the low-grade material located by the Kirk tunnel — driven from the opposite side of the mountain—and also found in some of the earlier churn drill holes. The churn drills have now been moved from the east side to the west side of the gulch in the hope of finding more low-grade ore, and to prove up the country in order to ascertain whether there are any parallel high-grade lenses at depth similar to the one already found on the east side.

So far, the high-grade ore that is being shipped has come solely from



Entrance tunnel to new orebody of Cananea Consolidated Copper Co.

development work but it is sufficient in quantity and grade to enable the company to curtail operations in the lower grade mines, and thereby reduce the working force. The entrance tunnel to the new orebody is in rear of the mine office, and is shown in the above photograph. It is only about two hundred yards above the old Democrata Mining Co.'s surface plant, and on the same side of the hill as their former workings, from which high-grade ore was shipped in the past. The loading bins are near the old Democrata smelter and the small hill beneath which the high-grade ore for this smelter was stoped. The caves above the old stopes are clearly visible to anyone driving past the loading bins.

Kirkland Lake Claims Amalgamated

Announcement has been made of the amalgamation of four groups in Kirkland Lake, Ont., totaling 300 acres. The amalgamation includes two claims of Federal Mines, Ltd., two claims of Kirkland Combined Mines, Ltd., five claims of W. H. Wright, of Wright-Hargreaves, and a fractional claim of Routley and Summers. The consolidated interests will now be known as Federal Kirkland Mines, Ltd., with an authorized capital of 4,000,000 shares of $1 par value. The properties lie north of Sylvanite and Tough-Oakes and have a length of 8,000 ft. on a break, identical in character with the main Kirkland Lake break, which is equal in length to Teck-Hughes, Lake Shore, and Wright-Hargreaves combined. A mine plant to operate to a depth of 1,000-ft. is now being assembled and construction work has already been started. A 200-ft. shaft which was sunk some time ago on the property shows a good grade of commercial ore.

New Attempt to Locate Meteor Near Winslow, Ariz.

Meteor Crater Exploration & Mining Co. Formed—To Operate Under Lease From Owner

IN THE past, many attempts have been made to locate the large meteor believed to have caused the depression in the plain in the vicinity of Winslow, Ariz. George M. Colvocoresses, formerly manager of the Southwest Metals Co., operating the Humboldt smelter, has recently announced the formation of the Meteor Crater Exploration & Mining Co., with $200,000 capital, for the exploration and development of the "crater." The new company will operate under a lease from the owner, Colonel D. M. Barringer, of Philadelphia, who will receive 25 per cent of net earnings.

E. H. Lundquist, president and manager of the Black Bess Mining Co., operating thirteen claims between Superior and Globe, has announced the opening of an oreshoot of lead and zinc several feet wide and 150 ft. long on the Black Bess property. This shoot, Mr. Lundquist states, lies at the 100 level and consists of good mill ore, as well as some exceedingly high-grade lead and zinc. The main shaft has been sunk to the 200 level, at which point crosscutting to the vein is under way. When the vein has been encountered on this level, the company expects to tap a lens of still higher grade and larger dimensions.

The company was incorporated last April, and now has a 50-hp. compressor and a 25-hp. hoist in operation. It has erected a blacksmith shop, mill building, and boarding house.

The Ray Extension Copper Co. of Ray, Ariz., is making arrangements to resume work in the development and operation of its 500 acres adjoining the holdings of the Ray Consolidated. Ray Extension has been developed to a depth of 700 ft., showing the vein to be more than 40 ft. in width in places, and traceable on the surface a distance of over 5,000 ft. on company holdings. On the 450 level of the shaft, deposits of commercial ore are said to have been exposed, from which some shipments have been made. Before hoisting operations can be resumed, the shaft must be retimbered to the 450 level. The property is fully equipped with all necessary machinery, and it is the intention of the company to resume shipments at an early date.

Not more than 450 ft. remain before the half-mile drift of the Phelps Dodge Corporation connects the C. & C. shaft with the new Warren shaft, at Bisbee, Ariz. At the rate work is progressing the project should be completed within the next thirty days. An average of 16⅔ ft. each day has been maintained since the work was started.

The drift has already been extended over a distance of 2,190 ft. The new Warren shaft has now reached a depth of 1,213 ft. As soon as the 1,800 level is reached, plans will be made for installing equipment to convey water through the half-mile drift. Water encountered in sinking is being handled by pumps placed on two different levels.

The United Verde Copper Co. at Jerome, Ariz., recently completed arrangements with the Aetna Life Insurance Co. to insure, without medical examination, all employees who have been in the service of the company for a period of six months or longer, under a group life, sickness, and accident policy. The new plan of insurance provides for the payment of the premiums on a fifty-fifty basis by the employee and the company. More than 1,800 employees of the company in Jerome and Clarkdale will benefit from the proposed plan. This co-operative plan does not in any way interfere with the workmen's compensation insurance. The insurance will become effective as soon as 75 per cent of the employees have agreed to the plan.

It has been reported that the Belmont Copper Co. has made a new high grade strike at its mine at Superior. A 4-ft. vein carrying excellent gold and silver values has been encountered on the 1,100 ft. level. No further details are at present obtainable.

Kirkland Lake to Receive Ample Power

Ample provision is being made to take care of the power requirements of the rapidly expanding Kirkland Lake gold camp. Already 3,000 more horsepower has been brought in from the plant of the Northern Canada Power Corporation at Indian Chutes. Early in October power will be available from the Quinze power plant, and the expectation is that this will provide all the power that this promising gold camp will ever want. By next spring the Quinze plant will have a capacity of over 40,000 hp., compared with the present installation of

22,000 hp. During the rest of the present year producers are likely to want considerably more power, and already Teck-Hughes has arranged for its needs for the 300-ton unit, which will bring its production up to 850 tons per day. This has been contracted for beginning the middle of November.

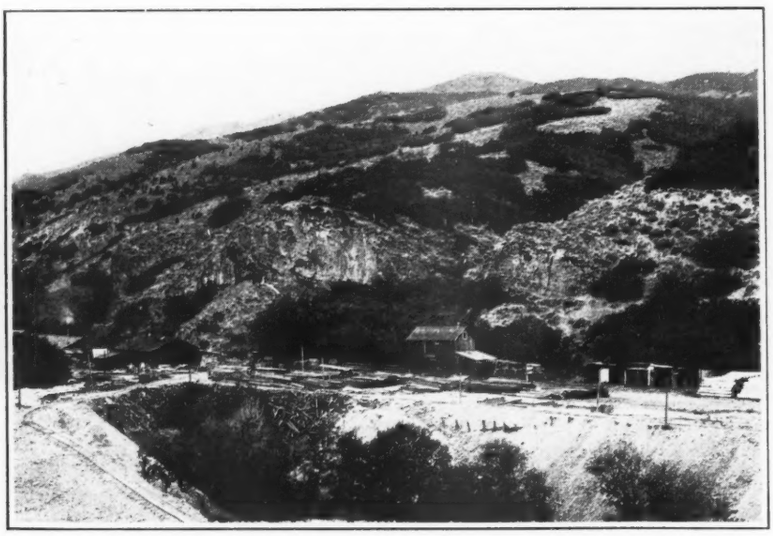
An addition is being made to the Kirkland Lake sub-station, which will about double its size. This should be ready about the end of September, and will take care of the increase in the transformer capacity and house a frequency changer.

Park Bingham Re-equips Butterfield Tunnel

The Park-Bingham Mining Co. is carrying on development work in two camps—Bingham, and at Park City, Utah. At Butterfield canyon, in the Bingham district, the company has recently completed the laying of two and a half miles of 30-lb. rails with new 6x6 in. ties in its Butterfield tunnel, which serves both the Park-Bingham and the United States mine. During the curtailment of production, ore has been developed to an extent that assures large scale shipments of a good grade of silver-lead ore from the property.

The Park-Bingham adjoins the United States mine of the United States Smelting, Refining and Mining Co., which has been productive since the early sixties, when one of General Connor's men located the first claim at Bingham, thereby instituting the Utah mining industry.

At Park City on the east line of the Park City anticline, where the Park Utah has opened up extensive deposits, the Park-Bingham company is running a tunnel to develop the Glencoe fissure, productive in the adjoining Park-Galena mine. The Park-Bingham property at Park City is thoroughly equipped with modern machinery and driving of the tunnel is proceeding at the rate of eight feet daily.



Surface plant at Park-Bingham mine

Record Mohawk Output Expected in Michigan Copper District

Estimated Yield for 1927 Is 24,000,000 lb.—Seneca Will Probably Remain Idle a Long Time—Production Rate Maintained by Copper Range

MOHAWK, in the Michigan copper district, is maintaining its high rate of production, and present prospects are it will report a record yield this year, probably 24,000,000 lb. refined. This estimate compares with 18,340,000 in 1926. Up to June 1 this year, Mohawk had produced 9,500,000 lb. refined, for the five-month period, and since June 1 production has been at the rate of more than 2,000,000 lb. per month. Several features have contributed to lower costs at Mohawk, including a higher yield in No. 6 shaft, an efficient labor organization and a light construction program. There has been no falling off in values in No. 6 shaft, which continues rich in the lower reaches. In many places the vein is abnormally wide, being at some points as thick as 30 ft., which compares with a normal width of 12 ft. The widening and greater richness of the lode will add materially to the life of the mine.

Unless Seneca is taken over by some one of the operating companies in the Michigan copper district, or copper becomes scarce, it is probable the property will remain idle for a long time. This is the conclusion drawn from Seneca's costs. The mine was at a considerable disadvantage as compared with properties having their own railroads, stamp mills, and smelters. Seneca's production cost was $1.80 per ton; transportation, 25c. and milling 70c. or a total of $2.75 per ton. This was exclusive of taxes, smelting, freight and marketing cost and eastern office expense. Seneca's cost of $2.75 for production, transportation, and milling compared with $1.87 for Mohawk.

Production by Copper Range is averaging about 2,000,000 lb. of refined copper per month. No new work in the way of exploration is being done. Costs at Baltic have been reduced by concentrating all mining operations in No. 3 shaft. Though the amount of developed stoping ground in reserve in the three mines of the company is not equal to that of ten years ago, the average of the last few years is being maintained. Ground to the south shows an improvement, particularly in No. 3 shaft, Champion. Values in No. 4, Champion, are fairly good, but not up to those of former years. The flow of subsurface water entering the mine at the south end remains about the same as last year and is being handled satisfactorily.

At Quincy, repairs in No. 2 shaft, which was damaged by fire, have reached a point below the 33 level. Better progress than was expected is being made, but there is no prediction of the time it will take to put the shaft in working order. This will depend on the extent of the damage below the 33 level. Meanwhile, mining is centered in No. 6 shaft. No decision has yet been reached as to the reopening of No. 8 shaft.

Calumet & Hecla Consolidated is shipping about 2,000 tons of rich rock per day from its conglomerate shafts. No. 4 shaft, Calumet branch, which has been idle since 1924 on account of fire damage in the upper levels, has been drained to the bottom, and mining will be resumed soon. The rock will be transported through the 81 level haulageway and hoisted through the Red Jacket shaft.

Dewatering operations have been resumed by Calumet & Hecla Consolidated in the old Crocker shaft at Phoenix, Keweenaw County, which will be used for exploratory purposes. The work was delayed by an explosion of marsh gas, resulting in the death of two workmen. Air pumps will be used for pumping, and, as a measure of precaution, safety lamps will be used by the miners. In the Avery shaft, at the old Cliff mine, pumps and piping are being installed to dewater a blind shaft 700 ft. below the present bottom. This work will take considerable time as the drifts and crosscuts are filled with water. The Avery also will be used as an exploratory shaft.

Arcadian Consolidated's new vein, encountered in a crosscut driven east from the 1,250 level of the New Baltic shaft, is believed to be the Old Arcadian lode. It is 280 ft. west of the New Baltic vein. Drifting is proceeding both north and south on the lode, and the copper content is commercial. The vein is 16 ft. in width, and the 6-ft. drift is heavily mineralized across the face.

Another Steel Mill Planned in Joplin-Miami District

Velie Mines Corporation is starting another shaft on its Leopard lease, located west of Baxter Springs, Kan. The shaft is being sunk near the north end of the lease, where a body of ore was indicated by the workings of the Brewster lease, directly to the north. The company is planning to build a steel mill on the lease this fall.

The Oak Hill Mining Co. is planning to erect a 150- or 200-ton mill on the Burgner land, three miles southeast of Carthage, Mo., in the Joplin-Miami district. The company has carried on prospecting on the tract for the last eight months, and has sunk a shaft to the 205 level. It has an 80-acre lease, and is capitalized for $20,000, with J. C. Ogle the largest single stockholder.

The Cortez-King Brand Mining Co. has started its new Sonny Boy mill, located southwest of Baxter Springs. It is a thoroughly modern mill with a capacity of approximately 300 tons per shift. The ground was well developed before the mill was erected.

B. L. Van Hoose, of Carthage, Mo., has purchased the old Hayseed tract of 80 acres, located a short distance northwest of Carthage. He also owns the Mignonette 80-acre tract, which adjoins the Hayseed, and plans general development of the ground as soon as zinc ore prices justify such action.

Production costs for the month of July, as announced by the Tri-State Zinc and Lead Ore Producers' Association, follow:

Operating Expenses	Cost per Ton of Rock Hoisted	Cost per Ton of Concentrates
Labor	.9433	13.4446
Supplies and repairs	.4069	5.7992
Liability insurance	.0594	.8464
Explosives	.1469	2.0939
Exploration and development	.1619	2.3080
Power, all classes	.2037	2.9035
Fire and tornado insurance	.9361	.5146
Management and office salaries and expenses	.1241	1.7680
Taxes (excluding federal income tax)	.0175	.2487
Miscellaneous	.0685	.9761
Total operating expenses	2.1683	30.9030
Amortization of capital cost of (a) Land, leases, development of mine (depletion)		3.4848
(b) Plant and equipment (depreciation)		2.5404
Royalty		4.9011
Total cost of production		41.8293

Victor Rakowsky, engineer and operator in the Joplin-Miami district, visited in Europe this summer and gave out an interview in Joplin recently wherein he declared it his belief that American zinc-ore producers have little reason to hope for much demand from Europe for their product within the next few years.

Cleveland-Cliffs Builds Concrete Power Dam

Cleveland-Cliffs Iron Co. has commenced work on a new concrete dam and power unit on the Escanaba River, Marquette range. This will add 2,000 kw. to the electric supply for the mines.

Satisfactory Development Reported in Tybo Section of Nevada

Treadwell-Yukon Co. May Erect Treatment Plant—Four Quartz Mountain Companies Consolidated—Production Increases in Divide District

REPORTS from Tybo, in the Hot Creek mining district about 60 miles east from Tonopah, Nev., indicate satisfactory developments in the work now being conducted by the Treadwell-Yukon Co., which has the main portion of the Tybo section of the district under option. Drifts on the 700 level have been advanced over 1,000 ft. on the vein, with commercial ore about four feet wide for half that distance. The ore contains lead and silver and is of excellent milling grade. The nearest railroad is at Tonopah, over 60 miles by road, so that it is not possible to consider shipping the ore to outside plants for concentration or smelting. The policy of the company appears to be to develop sufficient ore to justify the construction of its own plant on the ground, and several hundred thousand dollars has already been expended in repairing the old shaft, dewatering the mine to the 400 level, sinking the shaft to the 700, and drifting on the vein on this level. Several faults have been encountered in this work, as well as complicated geological problems, but so far no special difficulty has been experienced in finding the faulted segment in each case.

The work being conducted at Rattlesnake, about 10 miles north of Tybo, has so far proved to be disappointing. Crosscutting in the 150 level has disclosed no commercial ore, but work is being continued under promising outcrops. The MacNamara Mining Co., which has an option on adjacent ground in the Rattlesnake section, has ceased work after a several months' attempt to find reputed ore in the bottom of an old shaft.

STOCKHOLDERS in the San Rafael, Calico, Exchequer, and San Felipe mining companies, operating in the Quartz Mountain district of Nevada, at their respective meetings held in Reno on Sept. 6, ratified a plan for the consolidation of the four properties. Claims and assets are to be transferred to a new company, the San Rafael Consolidated Mines Co. The basis of stock exchange agreed upon was that one share of the new stock would be granted for two shares of the San Rafael Development Co., for four shares of Calico, for eight shares of Exchequer, or for eight shares of San Felipe. The San Rafael Consolidated Mines Co. has a capital of $300,000, represented by 3,000,000 shares of 10c. par value. Directors and officers are L. D. Gordon, president and general manager; George B. Thatcher, vice-president; W. E. Zoebel, secretary-treasurer; Arthur Thomas, and William Woodburn.

During the first six months of 1927 the San Rafael Development Co. shipped 3,957 tons of silver-lead ore, the average value per ton being $35.60 and the gross value, $140,800, with net proceeds reported as $17,774. The other companies entering into the consolidation have never produced any commercial ore, but their ground is favorably located with reference to the strike of the veins developed in the San Rafael Development Co.'s ground.

PRODUCTION from the Tonopah district for the first six months of 1927, as shown by bullion tax reports covering this period, was 60,897 tons of ore, which averaged $13.57 per ton, with a gross value of $826,583. This makes an average of 10,150 tons of $13.57 ore, and a gross value of $137,764 per month.

Actual production from the mines of the Tonopah district for this period was as follows: Tonopah Mining Co., 12,825 tons, average value per ton $21,261, gross value $261,192; Tonopah Belmont Development Co., 10,824 tons, average value per ton $19,117, gross value $206,929; Tonopah Extension Mining Co., 27,792 tons, average value per ton $8.73, gross value $210,251; West End Consolidated Mining Co., 9,456 tons, average value per ton $15.67, gross value $148,211. The only companies reporting a profit were the Tonopah Mining Co., with about $18,000 per month net, and the Tonopah Belmont Development Co., with about $3,000 per month net. Tonopah Extension and the West End Consolidated reported no net proceeds.

A summation of the gross production of the different companies, as evidenced by the bullion shipped from the various mills, indicates a gross value of ore milled as approximately $960,000. This indicates that custom ore from outside sources handled by the mills had a value of about $133,417. Most of this ore came from the Divide district, 5 miles south of Tonopah, with scattered lots from small camps near Tonopah.

The Divide district is increasing production, and it is estimated August's total will exceed $15,000 in value, compared with an estimated total of $10,000 in July. The Thomas-Robillard lease, on Brougher Divide Co. ground, has so far been the most productive, but the Sanger-Camp lease block, adjoining on the west, is looking good, and promises to be quite a factor during the coming months. Leasers on the old Tonopah Divide ground are also producing at a profit, and some gold ore has been shipped from the Belcher and Verdi companies' ground, which appears to have excellent future prospects. All ore produced in the Divide district is milled either in Tonopah or Millers, at the plants of the West End Consolidated and the Tonopah Mining Co.

Representative Group From Mining Industry to Visit Washington

To Appear Before Director of the Budget—Will Point Out Need for Research and the Potentialities of New Methods of Prospecting

By Paul Wooton
Special Washington Correspondent

WORD has reached Washington that a strong group thoroughly representative of the mining industry and well acquainted with its needs will visit the Capitol in the near future to appear before the Director of the Budget to point out some of the basic requirements of the industry in the hope that it may receive more nearly its rightful proportion of attention from the Federal Government. It will be pointed out to Budget Director Lord that for every dollar the Federal Government allows the Bureau of Mines and the Geological Survey, two mining bureaus, it allots $33 to agriculture; or, since the gross production of agriculture is twice that of American mines, the ratio of allotment on that basis would be sixteen to one.

Fundamental research and stimulation along lines which can be followed only by the Federal Government are particularly necessary in connection with mining, it will be pointed out, because of the need for keeping alive a mining enterprise while it is going. When depressions cause the abandoning of mines their rehabilitation is a matter of great expense. An agricultural crop may fail or be marketed at a loss one year without burdening with expense the crop which may be raised the succeeding year. The need for research and guidance in the handling of an output which is not self-perpetuating is held to be the more important. In the winning of minerals there is only one crop, so that any study which helps in the discovery of new deposits or in devising means to utilize low-grade minerals is setting further in the future the date of the exhaustion of essential materials. The committee of the industry hopes to impress the financial department with the fact that it has not grasped the importance of mineral production in its relation to the economic life of the nation—production which furnishes the railroads with half their tonnage and produces $6,000,000,000 in gross value every year.

THE group, it is expected, will bring forcefully to the attention of General Lord the potentialities of new methods of prospecting. A year ago General Lord refused a request for $15,000 to be used for the specific purpose of investigating geophysical methods of prospecting. Despite this the Bureau was able to use some of its minerals investigations funds for such a study. The results of the summer's work, even on a small scale, are such as to indicate that the refusal of the money last year was one of the worst mistakes in judgment chargeable to the Budget Bureau. There can be no doubting the strength of the demand for studies of the principles underlying those methods of prospecting. The finding of only one small new deposit as the result of information thus developed would more than repay the Federal Government for its contemplated expenditures through the addition to the national wealth. By bringing home to the financial officers of the government such facts as these it is believed that the way can be paved for more liberal treatment of the mining industry and a service to the general public also will have been performed.

No change in the duty on manganese is at issue in connection with the investigation now being made by the U. S. Tariff Commission. Apparently this is not understood by many, as the commission is receiving a large number of letters presenting arguments for and against a reduction in the rate of duty. The investigation now in progress is a general study, the results of which will be transmitted to Congress and made available for public distribution. It simply will present facts about the manganese situation which will be available should Congress take up the matter, or should the commission decide to consider it under the flexible provision of the law.

STEPS are being taken by the Interior Department to expedite field examinations of mining claims. In connection with this program the following instructions have been issued to the department's Land Office officials, engineers, and inspectors:

"In order to facilitate examination in the field by inspectors of this department of mining claims for which applications for patents are filed, registers, where lode claims are sought to be patented, will require the applicants to furnish in duplicate the statement required by Paragraph 41 of the mining regulations, relative to the kind and character of the vein or lode; whether ore has been extracted therefrom, and, if so, in what amount and value, and the precise place within the limits of each claim sought to be patented, where the vein or lode has been exposed or discovered and the width thereof. The duplicate copy will be sent to the division inspector.

"The procedure in this regard, in the case of placer claims sought to be patented, is contained in the instructions of Nov. 4, 1925, to the register of the Glenwood Springs, Colo., land office, which instructions are extended to all district land offices.

"District cadastral engineers will cause to be made a copy of the description of the improvements on mining claims as contained in the field notes of survey and transmit this copy to the division inspector."

The President has released the $225,000 necessary to make the initial payment on the helium project in the Cliffside structure near Amarillo, Tex., where the gas carries a favorable percentage of helium.

Contentions of the Silver King Consolidated Mining Co., of Utah, with regard to certain reductions in the amount of its invested capital made by the Commissioner of Internal Revenue, have been upheld by the U. S. Board of Tax Appeals.

The question involved was the correctness of the commissioner's action in deducting from current earnings, available for the payment of dividends, an amount on account of income and profits taxes, known commonly as the "tentative tax." The Appeal Board found for the period in 1917, under review, that the company had paid dividends as follows: March 31, $103,287.15; June 30, $103,287.15; Oct. 1, $103,287.15, and Dec. 31, $68,858.10.

DIVIDENDS in the period exceeded the available current earnings of the corporation, and it is agreed that to the extent of such excess the said dividends were paid out of the prior years' surplus and that by reason of that fact the invested capital for the eleven months' period ended Dec. 31, 1917, should be approximately reduced.

In determining the current earnings available for payment of the dividends the commissioner reduced the earnings of $291,339.17 for the eleven months' period by the sum of $84,125.71, tentative income and profits tax, and the remainder he held to be available for the payment of dividends at the dates of such payments in the proportion which the number of months and fractions thereof from the beginning of the taxable period to the dates of payments of dividends bears to the total number of months in the period.

In its opinion the board holds that "the invested capital of a corporation may not be reduced in determining the extent to which a dividend is paid from current earnings of a year by a so-called tentative tax." It follows that the tax liability herein should be computed without adjustment on account of a tentative tax.

Asphalt Mining Operations Begun Near Cline, Tex.

Mining of asphalt rock on a large scale was started near Cline, Tex., recently by the Limestone Rock Asphalt Co. It is stated that the deposit which the company owns is very large and that the material runs high in asphalt. It is being used chiefly for road building purposes. B. V. Sharp is manager of the property.

Johannesburg Letter

By John Watson
Special Correspondent

Mond Company Experiments with African Platinum Concentrates

Johannesburg, Aug. 16—At the annual general meeting of the Mond Nickel Co., Ltd., held recently in London, Sir Alfred Mond, the chairman, referred to the position of the platinum metals, which the company produces on a considerable scale. These metals occur in the nickel-copper Sudbury ores and are recovered practically as byproducts at the end of the extraction process. The company has for some time been refining some of the South African platinum concentrates at the Acton works. A study has also been made of the norite sulphide platinum occurrences in South Africa, which are similar to the company's Canadian nickel ores, with the difference that the percentages of nickel and copper in the Transvaal ores are extremely small. The precious metals, though larger in proportion, are very diffused. As a result of experimenting on the extraction of the precious metals from the concentrates Sir Alfred thought he could say with a fair degree of certainty that the process which the Mond Nickel Co. has developed is one which will be suitable for this purpose.

Onverwacht Platinum, Ltd., reports that in July 2,415 tons of ore was milled and that platinum metals recovered were estimated at 680 oz., equivalent to 5.63 dwt. per ton milled. The prospecting winze disclosed values averaging 2.66 dwt. for 27 ft. sunk below the 450-ft. level. For the quarter ended June 30, 2,275 oz. of refined platinum realized £29,326 net, or £12 17s. 10d. per ounce. In the previous quarter 2,453 oz. realized £44,397, or £18 2s. per ounce.

Lydenburg Platinum Areas, Ltd., states that for July, in the Maandagshoek section, 2,940 tons of ore was milled and 424 oz. of platinum group metals won.

Eerstegeluk Platinum Mines, Ltd., reports, for the quarter ended June 30, a total development footage of 6,390; sampled, 5,361 ft.; average value, unreduced, 5.9 dwt.; reduced to width of 36 in., equal to 5.3 dwt.

THE value of the mineral output of Southern Rhodesia for June amounted to £355,878, representing an increase of £3,034 over May. A summary of the output includes: Gold, valued at £223,418; silver, £878; diamonds, £25; base minerals, £131,557; chrome ore, 17,140 tons valued at £40,549; and asbestos, 2,950 tons valued at £53,685. The mineral production of Northern Rhodesia for June was valued at £29,344, including £16,934 for finished copper, and £12,297 for lead. Southern Rhodesia's grand total of minerals produced to date is valued at £84,555,016 and Northern Rhodesia's at £3,935,464, making a total valuation of £88,490,480.

From June 2 to July 7, 5,111 tons of copper ingots from the Belgian Congo were shipped at Port Elizabeth to the United States. From Ottoshoop, in the Transvaal, 257 tons of fluorspar and 35 tons of galena were shipped to Durban, during June, for export to the United States. In June, 165 tons of tin concentrates were forwarded from Warmbaths, Potgietersrust, and Lothair to Durban for shipment. Copper ingots totaling 637 tons were moved from Messina in the northern Transvaal to Lovrenço Marques for export.

The Department of Mines and Industries has recently issued the following statistics of the mineral output of the Union for the six months ending June 30:

	Value
Gold	£21,326,416
Diamonds	6,672,932
Coal	1,856,555
Copper	279,212
Tin	175,475
Platinum	93,483
Silver	59,128
Osmiridium	27,408
Other minerals	219,758
Total value	£30,710,367

The output of gold for the month of July was declared on Aug. 10 by the Transvaal chamber of mines as 851,861 fine ounces, having a value of £3,618,476. As compared with June, these figures are a decrease of 3,293 fine ounces, equal in value to £13,987. The native labor returns show a decrease of 1,935 "boys" working on the Rand gold mines at end of July as compared with the end of June.

The analysis of Transvaal gold production for the first half of 1927 shows that the output of gold was 5,018,279 fine ounces compared with 4,889,196 for the corresponding period of 1926. Working costs show an increase, from 19s. to 19s. 7d. per ton, the increase largely being the result of an inadequate supply of native labor. This figure of 19s. 7d. represents an expenditure for the half year of £14,499,134, nearly half of which has been paid out in salaries and wages to whites and natives, the balance paying for mining supplies. The greater proportion has been spent within the Union. In June, the average number of white men employed in the Transvaal gold mines was 21,597, and the average number of natives 188,142; this latter figure is 7,000 below the full normal requirements of the mines.

Estabrook Dredge Shut Down

On Aug. 25 the Estabrook Gold Dredging Co. shut down its gold dredge on the Trinity River near Trinity Center, Calif. The dredge has been in operation for several years, but the returns are said to have been indifferent. It is believed that the present shutdown is to be permanent. W. H. Estabrook is president and general manager.

Toronto Letter

By Our Special Correspondent for Northern Ontario

Coniaurum Mines Clearing Site at Porcupine for New 500-Ton Mill

Toronto, Sept. 10. — Coniaurum Mines of Porcupine, which is controlled by the Coniagas Mines of Cobalt, has started clearing a site for its 500-ton mill. It is expected that production will start late in the spring of 1928. The shaft is being sunk from the 1,500 to 2,000 ft. point and is now at a depth of 1,750 ft., where a level will be cut. Lateral development will not be attempted on the new levels until the shaft sinking has been completed.

A new producer has been added to the list of active Boston Creek properties by the Gold Hill Mines starting its mill on Sept. 1. The ultimate success of this property depends on whether or not a profit can be obtained from the narrow stopes being worked; officials of the company are confident it can be done. With the mill in operation development work will now be pushed.

There was a slight decrease in tonnage in August but higher average recovery at the Dome Mines. The company milled 47,300 tons of ore as compared with 47,690 tons in July; the recovery for August was valued at $330,436, representing an average of $6.99 per ton, as compared with $329,901 and an average of $6.92 per ton for July.

JAY Copper-Gold Mines, of Rouyn, announces that the No. 1 vein was cut at the 400 ft. level with the grade of ore as good as that encountered at the 200 and 325 ft. levels. The vein at the 325 ft. level was 10 ft. wide, and has been widening with depth. After the width of the vein has been determined, it is proposed to resume shaft sinking to the 500 ft. level, at which level extensive lateral development work will be undertaken and a crosscut driven to open up the No. 2 and No. 3 veins, the latter having a width up to 30 ft on the surface.

Station work and crosscutting at the 500-ft. level of the Aldermac Mines, of Rouyn, has shown a width of over 50 ft of ore at that horizon. This is the ore body followed by the shaft for 80 ft. from just below 400-ft. level. Diamond drilling recently penetrated ore 300 ft. north of previous discoveries, but as yet no details are available regarding widths and values, although they are understood to be important.

McDougall Mines proposes to resume diamond drilling on its ground adjoining Amulet on the east and on which previous drilling encountered an extension of Amulet's No. 2 zone. Underground work on the 100-ft. level of McDougall's No. 4 shaft, on the ground

adjoining Amulet and Area on the west, has been so encouraging that it has been decided to construct a complete mining plant on the property.

Abana Mines, Ltd., are making preparations to develop the 300-ft. level of their property. The sump is being sunk 25 ft. below the 300-ft. level and the timbering of the station is completed. When this work is finished the crosscut through the ore zone will be continued another 50 ft. to cut the remaining orebody, which is within 8 ft. of the present crosscut. This deposit was cut by the drill 125 ft. east of the shaft and showed a width of 13½ ft. of good ore.

The Mining Corporation, of Cobalt, is working south on an excellent vein on the 1,425-ft. level at the Frontier property in South Lorrain. A west crosscut encountered the Woods vein on the same level last week. A winze will be sunk on this vein into the Keewatin. A station is being cut at the 400 ft. level on the Cross Lake property, and exploration work will be undertaken shortly. No definite news on the company's Flin Flon property is expected until December.

Extend Canadian Railways Into Mining Districts

Construction of a railway from The Pas to the Flin Flon mining territory of Manitoba is possible in the near future, according to information given out by Canadian National Railway officials. A charter for building a railway from The Pas to the Flin Flon property was granted by the Manitoba government in 1926 and renewed in 1927.

Capitalists interested in the development of the Flin Flon have, in the last year, done much exploration work preliminary to more active development, and it is understood that this work has advanced to a stage where the need of more adequate transportation facilities is imperative. Holders of the option on the Flin Flon are holding conferences with Canadian National Railway officials in Montreal with the hope of obtaining construction of a railway at an early date.

The new line which the Temiskaming and Northern Ontario Railway is building into Rouyn, Que., will probably be opened about Dec. 1. When completed, it will be the shortest route into Rouyn from Toronto and Ottawa.

To Mine Asphaltic Deposit at Sunnyside Property

Colorado capital will mine an asphaltic-silica deposit at Sunnyside property near Price, Utah. Thirty men are now employed in building roads. When production is started, it is said, 100 men will be employed steadily. The Sunnyside deposit consists of a silica product carrying an asphaltic matrix which makes the material ideal for road surfacing purposes.

Mexico City Letter

By W. L. Vail
Special Correspondent

Situation at Amparo Mine Improves With Arrival of Federal Troops

Mexico City, Sept. 7.—Latest reports from the Amparo mine, in Jalisco, state that the situation has greatly improved since the arrival of a small picket of federal troops. The pumps are working and all sabotage has been stopped. Most of the foreign employees are apparently back at the mines awaiting the outcome of efforts on the part of the authorities to iron out the differences between the "Red" strikers and the management, and between the two factions of the labor unions. No serious trouble is anticipated at this time. Mining conditions are reported more or less normal in Oaxaca. Natividad is preparing to resume work after a short suspension, the American Smelting & Refining Co. is working a full force in Taviche, and several other properties are working in the Sierra Juarez. The labor troubles appear to be spasmodic and of little importance.

The Teziutlan Copper Co., at Teziutlan, State of Puebla, is producing about 300 tons of zinc and copper daily. This concern has had considerable trouble with the local organization, but at the present time there appears to be no friction.

THE statistical department of the government has announced the following figures regarding metal production in the republic during the first six months of this year: 292,260,833 kg. of ores and metals of all sorts, valued at 148,261,368 pesos, as against 278,800,647 kg., valued at 158,962,000 pesos, for the first six months of last year. It will be observed that while the total production for the six months of this year exceeded that of 1926, the value decreased as a result of the lower prices of all metals, and particularly owing to the decline in silver, lead, and zinc prices.

The government has declared void sales of large salt deposits on the coast above Tampico and around Soto de la Marina made in 1863 to Ramon Obregon. The transaction was effected for the sum of 30,000 pesos; the Obregon family has been in possession of the property and has operated it ever since the time of purchase. The confiscated lands are now subject to denouncement under the most recent mining laws of the country.

Through the efforts of the Chihuahua mining chamber, which has been unusually active and effective in looking after mining interests, it is possible that the various overlapping importation taxes may be consolidated into one tax, which may also effect a slight reduction. The Chihuahua body recently presented a memorial to the secretary of the treasury setting forth the disadvantages and frequent embarrassments of the present system and complaining specifically of the recent increase in consular fees. In reply the secretary states that the president has ordered a revision of the situation and hopes to be able to harmonize the interests of the government with those of importers, particularly with the mining concerns which have found reason to complain. The 1928 budget, which contemplates a reduction in governmental expenses of 50,000,000 pesos, is now being prepared for submission to congress, and the new tariff schedules will figure therein. Owing to a loss in revenue on oil this year, the government is forced to make up this loss from other sources. The new budget proposes to obtain most of its funds from: first, business taxation direct; second, taxes on imports and exports; third, stamp tax, and fourth, mining taxation. The total estimated amount required for running the government next year is 350,000,000 pesos. As the oil tax was the basic means of taking care of the foreign debt interests, it is expected that the government will shortly propose a revision of the present agreement with the New York City bankers.

According to a recent government statement 2,476 mining properties were forfeited in 1924, 6,735 in 1925, 2,063 in 1926, and 1,031 during the first six months of 1927. Also, for the first six months of 1924 there were 1,019 denouncements of new properties, 1,643 in the first six months of 1925, 1,575 the first six months of 1926, and 973 the first six months of this year. The government accounts for the recent falling off in denouncements by the fact that the new mining law requires constant work on claims, whereas under the old laws many denouncements were made for purely speculative purposes, the government receiving no taxes and the public no benefits. It is also stated that 775 exploration concessions have been granted since the first of the year, 772 working contracts, 114 new companies have been registered for business, and that accidents are 33 per cent less in the mines than during a similar period last year.

Dredging of Gypsum Deposit Near Alamogordo Planned

Exploitation of a deposit of white gypsum sand, situated near Alamogordo, N. M., will be carried on by J. W. Ady of Denver, H. E. Lindus of Alamogordo and their associates, if their application for the purchase of 58,000 acres of the deposit is granted by the government. In a report made by John Melhase, Southern Pacific geologist, he estimates that the deposit contains a total of 33,000,000 tons of gypsum sand. The project of Mr. Ady and associates involves the construction of an electric tram line from Alamogordo to the white sands, a distance of eighteen miles. Mining will be done by the dredging method. A water line will also be laid from Alamogordo to the scene of mining operations.

Societies, Addresses, Reports

In Canada with the British Empire Mining Congress

By A. B. Parsons
Associate Editor

En route, Tadanac to Princeton, B. C., Sept. 12.—There must be something in the notion that living in the Great West makes people different. Out here they are a little less reserved, a little less wrapped up in their own affairs, a little more human, a little more natural in their contacts with their neighbors and with strangers, than are those in the East. It is true in the United States and it is true in Canada. In making this statement I am not expressing my own conclusions but reflecting those of prominent members of the British Empire Mining Congress, now nearing the end of its journey across the continent.

In the East, and particularly in the mining districts in Ontario, everything imaginable was done to entertain the Congress. No one could ask for more cordial hospitality; and yet somehow it didn't get under the skin as it has since leaving Winnipeg. As one Londoner says, they make you feel that they and not we are the favored ones.

Estevan Hospitality

Take Estevan, a small coal-mining center in the prairie of Saskatchewan, that cannot have more than 1,000 inhabitants. When the Congress arrived 105 automobiles were lined up four abreast to take the various groups ten or fifteen miles to the different mines. Where those automobiles came from is a mystery. If more than three passengers got into a car some one came and demanded that the fourth get out for fear there would be some empty ones at the end of the lines. Luncheon was served at five of the mines. At the Bienfait, owned by "Bob" Hazzard—there "in person," if you please—fifty delegates had a home-cooked feast in a small unpainted shack that one never would suspect of sheltering so much good food. There were actually five kinds of desert. It was here that R. E. Palmer, in an after-dinner speech, was moved to inquire whether the cows of Canada gave anything but cream. Afterward the cook, her daughters who helped serve, and all hands had their pictures taken.

The same spirit prevailed in the Crowsnest Pass coal districts, though the mining operations there are on a larger scale. Half of the Congress was entertained at Blairmore, where a musical program was the feature of after-dinner festivities. Blairmore boasts a first-class orchestra, a violinist, and a lady with an excellent voice; and it was a question whether these or the community singing, participated in vociferously by dignified Londoners and everyone else, aroused the most enthusiasm. Dr. E. C. Andrews, of Australia, and J. M. Cairns, of London, told some funny stories, and a good time was had by all, as the saying goes. The party was half Congress and half Blairmore; but they sang "O Canada" as if all had been born in the Canadian Rockies.

Then came Kimberley and the great Sullivan mine and concentrator of the Consolidated Mining & Smelting Co. Presently I will tell a little of the technical activities of the company; but first something must be said of the way the company treated its guests. At the concentrator, which was declared on every side to be the most nearly perfect plant of its kind that the delegates had ever seen, each visitor was presented with a 33-page handbook giving in remarkable detail the method of treatment, the equipment used, the results obtained, and frequently the reasons for doing things as they are done. At different points in the plant sixteen large signs were erected, giving station numbers corresponding with numbered sections in the pamphlet, so that anyone knowing the rudiments of flotation practice could follow the treatment by himself. In addition a group of guides headed by R. W. Diamond, superintendent of concentration, with headquarters at Tadanac; C. T. Oughtred, superintendent of the Sullivan plant; H. R. Banks, assistant superintendent; and C. A. Remington, metallurgist, answered 42,508 questions verbally. Incidentally most of the answers could have been found in the book, if the askers had had the time to look for them. That was the only shortcoming of the visit—it was too hurried. The booklet was especially prepared for the Congress and had come from the printer only the day before. However, through the courtesy of S. G. Blaylock, general manager for the company, the most important data will be reprinted in *Engineering and Mining Journal* in a week or two.

Left to right—E. C. Andrews, Melbourne; Mrs. G. C. Klug and G. C. Klug, Kalgoorlie

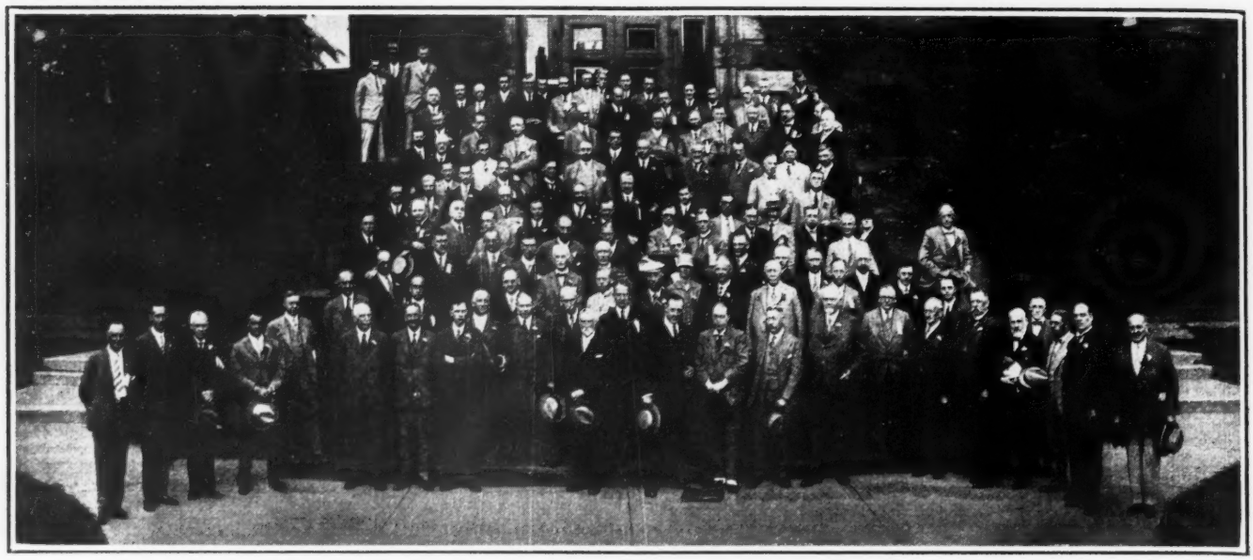
The Australian Delegation

Underground Passenger Trains

The mill could be seen to the best advantage while in regular operation; at the mine it was different. The entrance is an adit about 12,000 ft. long, through which men and supplies are hauled in, and ore is hauled out, by electric locomotives. Two special "passenger" trains—smoother riding than some of the Canadian Pacific trains, by the way—were operated for the benefit of the visitors. One of these ran in the morning and another in the afternoon. The result was that haulage of ore was interrupted, as I discovered when making a special visit to the concentrator in the evening. The roll plant was shut down for the reason that the bins were empty. It might be mentioned in this connection that recoveries by flotation are spoiled unless the ore is comparatively fresh; and accordingly the storage of ore provided between the stope and the flotation machines is a minimum. Apparently the company had considered the comfort and convenience of its guests first and the requirements of the mill second. Every visitor was provided with a complete new underground suit, including, if he desired it, an extra pair of heavy woolen socks to protect tender feet from the ravages of rubber boots.

Stopes Lighted by Searchlights

The trip through six or eight stopes was facilitated by the erection of steps and the provision of guide ropes in some places. It looked as though a lot of special trails up and down the sides of the immense caverns had been prepared, but the guides said that most of these were in regular use. A number of strong searchlights were provided to illuminate the trails and the roofs of the stopes in some places. A stope is started from the top of a raise perhaps 250 ft. high to the hanging wall. Leaving an arched back, it is worked downward by benches, the sides being kept steep enough for the broken ore to gravitate to the chutes just above the main haulage level. No timbering whatever is required, and the result is the excavation, between pillars, of empty caverns several hundred feet long and 100 ft. or more wide. Connections are provided between adjacent stopes, and through these the visitors trailed in single file. Looking up from the bottom



The Congress at Toronto University

of one of the stopes at a long line of 125 twinkling lights slowly descending the steep side was a sight long to be remembered, and it was an experience that few of the members of the Congress had ever enjoyed.

Dance at Kimberley

To get back to the theme of Western hospitality. At noon, between the mine and mill trips, the two groups into which the party had been divided were brought together at the mine boarding house for luncheon. W. M. Archibald, manager of mines, and his assistant, E. G. Montgomery, briefly performed the formalities of welcome. In the evening automobiles were provided to take the Congress delegates and visitors from their trains to the company's splendid recreation hall, where a dancing party was on the program. As I had returned to the concentrator for a few more hours with the art of selective flotation, I can speak only on second-hand authority, but I am assured that the dance was a distinct success. It seems that the company's men brought their wives and sweethearts, introduced them to the members of the Congress, and then retired to the background. Heretofore, owing to the comparatively small number of lady dancers on the tour, the masculine contingent has played the part of spectators during most of an evening of dancing. They had all the partners they wanted at Kimberley, partners, they gallantly declare, whose charm was surpassed only by their skill as dancers. This correspondent feels that the visiting gentlemen should feel grateful to him for this public expression of their feelings in the matter.

Boat Ride on Kootenay Lake

Next day came a Sunday boat ride aboard the steamship "Nasookin" on Kootenay Lake, charming and picturesque in spite of cloudy weather and frequent showers. At Kootenay Landing, a committee headed by F. A. Starkey, of the Associated Boards of Trade, with headquarters at Nelson, and A. G. Langley, resident provincial mining engineer, welcomed the visitors personally and individually, and made everyone feel at home with an invitation to visit room number twenty-seven. Few sent regrets. J. W. Millholland, who describes himself as a plain prospector, had a fine collection of ore specimens which he exhibited especially for the occasion. A three-hour ride brought the boat to the Bluebell mine, operated by S. S. Fowler and B. L. Eastman. Here for the first time in its more or less triumphant journey across the continent the Congress was met by a band, or perhaps it should be called an orchestra. It consisted of an accordion, a fiddle, a saxophone, a drum, and a cornet. The cornetist and leader was Captain Charlie Sherman, mine boss at the Bluebell. He was rather informally attired in his shirt sleeves, and was hatless and collarless. However, he could play his cornet; and so well pleased were the members of the Congress that the orchestra got aboard the boat and played at intervals all the way back to Nelson, and on the special train that carried the visitors to the Bonnington Falls power plant.

Visit Bonnington Falls Plant

The host at Bonnington Falls was L. Campbell, general manager of the West Kootenay Power & Light Co., which is a subsidiary of the Consolidated Mining & Smelting Co., and which supplies hydro-electric power for its activities at Trail. Two plants in operation at present generate 90,000 hp., and work is now under way for the addition of 70,000 hp. At the dinner served by the company one speaker was inclined to credit Mr. Campbell with building up the power business of the company. Mr. Campbell built the plants and did an excellent job, according to the engineers in the Congress who are versed particularly in such matters; but if it had not been for the Sullivan mine, which supplies most of the ore for the Trail smelter, it is not likely that expansion beyond the original 30,000 hp. would have been warranted.

Consolidated Ideal Host at Tadanac

Once again the Consolidated proved itself an ideal host at the smelter at Tadanac today. Because of a change in the schedule, only two hours before luncheon was available to go through "the largest non-ferrous metal reduction works in the world." But so well was the visit organized that one was able to get a nodding acquaintance with practically every part of the huge plant. A blueprint and a printed folder were handed to each visitor at the start. The blueprint was a plan of the works on which the route to be taken was clearly indicated and the names of the various departments were lettered. On the outside of the folder the itinerary was shown in flow-sheet form and within, under corresponding numbers and captions, were printed salient details as to the equipment and processes in each department. Among the guides were J. Buchanan, smelter superintendent; George Murray, assistant superintendent, who, I can testify personally, did not falter for an instant under a continuous fire of questions from a dozen inquisitors; B. A. Stimmel, zinc-plant superintendent; F. S. Willis, his assistant; R. W. Diamond, superintendent of concentration; R. K. Blois, in charge of Cottrell treaters; and E. M. Stiles, chief engineer.

Luncheon in Machine Shop

Luncheon was served in the new machine shop just being finished. This building makes one large room, 64 by 212 ft. and about 40 ft. high. It served well as a banquet hall, except for the fact that the acoustics were terrible. Just to indicate the thoughtfulness of the hosts it may be mentioned that, although the weather was not even chilly, a dozen

coke salamanders were provided to make sure that no one would be uncomfortable. Mr. Buchanan and other officials acted in the capacity of waiter-captains and personally saw to it that everyone was comfortable. As we travel westward this afternoon, the Congress is singing the praises of Mr. Blaylock and the staff of the Consolidated Mining & Smelting Co.

Selective Flotation Important at Sullivan Concentrator

To try to give any adequate review of matters of engineering and technical interest at Kimberley and Tadanac is out of the question. However, a few points may be mentioned. The production of the Sullivan mine in 1926 was 1,081,989 tons of ore, containing 4,900,000 oz. of silver, 252,000,000 lb. of lead, and 127,750,000 lb. of zinc, and having a value of about $29,000,000. The ores are essentially replacement deposits in argillaceous quartzites, occurring conformably with the beds in a general way, but possessing some of the features of a vein. Because of the very intimate association of the sulphides of lead, zinc, and iron—galena, marmatite, pyrite, and pyrrhotite—the typical ore could not be beneficiated profitably until selective flotation had been successfully developed. The orebodies are large massive deposits, ranging up to 200 ft. in thickness at places. Shrinkage stoping would suggest itself as a method of winning the ore; but it cannot be used because of the necessity for getting the ore into the mill as quickly as possible after breaking. The minerals oxidize rapidly and satisfactory recoveries by flotation depend upon treating comparatively fresh ore. The present system is a sort of underground glory-hole system that is very cheap. Contractors, who pay for their own powder, break the ore at costs ranging as low as 16.5c. per ton and averaging about 25c. Just how the pillars, amounting to about one-third of the volume, will be mined has not been fully determined, but that is not a problem as yet. Current output comes from twenty stopes averaging something less than 200 tons each per day. The company has made no statement indicative of the ore reserves, but the enterprise can safely be classed as an "industrial," with a supply of raw material assured for many years.

Efficiency and Cleanliness Attract Attention

Near the mouth of the main operating adit is the coarse-crushing plant, where the ore is reduced to 2½-in. size for transportation to the concentrator situated about three miles away at a lower elevation. Details of this plant will be published later. Much has been written about the excellence of this concentrator in design and construction and about the efficiency and cleanliness of operation. It can be said without hesitancy that in outward appearances at least it more than lives up to its reputation. In concluding articles on the Congress in the next two weeks I shall tell of some of the new work at the smelter at Tadanac.

This and That

WHEN the Prince of Wales visited the Sullivan mine recently, he was introduced to the man in charge of the change house where the miners change their clothes and bathe. The man was also a war veteran; and after talking to him on that subject for a few minutes the Prince remarked, "I want to compliment you on the splendid condition in which you keep this change house." Such places are not always kept clean. The next day Bill Lindsay, superintendent of the mine, happened into the change house. The war veteran buttonholed him and said: "Say, Bill,

Left to right—Alpheus Williams and P. H. Anderson

At the Keeley Mine

the Prince of Wales is satisfied with the way things look around here, so I don't ever want a peep out of you!"

* * *

A. F. Brigham, general manager of the Hollinger, formerly was manager of one of the big diamond mines in South Africa, and a great friend of Alpheus Williams, now manager of De Beers. Naturally the two had quite a reunion when the Congress was at Timmins. I have in my collection a kodak picture of them which Mr. Williams thinks is very good. However, Mr. Brigham says that if it is ever published there will be a homicide, with this correspondent in one of the leading rôles. He (the correspondent) will make a virtue of discretion.

* * *

A story that might be told on the manager of most any famous mine, but that is vouched for as being authentic in the case of Mr. Brigham, runs as follows: A young graduate from McGill University applied for a job at the Hollinger. He was not particular just what the work was, but understood that most engineers started as samplers underground. After telling him that there were no openings at the moment, Mr. Brigham went on to explain that it was a very expensive procedure to break in new employees on the engineering staff. He said that if he gave the applicant a job it would cost the Hollinger company $2,000 to acquaint him with the mine and the work and make him a really valuable member of the staff. The young man promptly replied, "Well if it would cost $2,000 to break me in as a sampler, it must have cost the company $5,000,000 to break you in as general manager." The story ends at this point, unfortunately or fortunately.

* * *

"Owing to rainy weather, roads to Turner Valley and E. P. Ranch are not safe for rapid transit of the Congress. The Congress will remain at Banff until Thursday, Sept. 8." So read the notice posted in the lobby of the hotel Wednesday morning. The suspicion lurks that the position would have been described more accurately if the preamble had read "Hoping that the sun may come out tomorrow and give the delegates a chance to view the scenery under more favorable circumstances, etc." And the sun certainly did its part. If ever there was a day when the majesty of the mountains, capped with the snows of the day before, and the exquisite beauty of the streams, whose canyons meet below the hotel, showed to better advantage, the oldest inhabitant of Banff cannot remember it. Sept. 8 will remain as a red-letter day for the members of the Congress who had never been in Banff before.

* * *

In replying to a brief speech thanking the Teck-Hughes company for its hospitality, D. L. H. Forbes, the manager, remarked that the visitors had just seen "the stimulus to all the penny gold stocks in Canada." In 1922 Teck shares sold for 15½c., and this year they have reached $8.60. Mr. Forbes did not call attention to this fact, but the brokers never tire of doing so.

* * *

R. E. Palmer, of London, wonders whether the cows of Canada produce nothing but cream. Back home they get skimmed milk for their tea; in Canada rich cream in unstinted quantities is offered on every hand. Not only in respect to tea but in every other way the mining people of Canada are giving the cream of things to the members of the Congress.

* * *

At the Sullivan mill my attention was called to the fact that the froth-killing device where the flotation concentrate runs into the thickeners was an adaptation of a scheme described in "Useful Operating Ideas" in the *E. & M. J.* That idea alone, said my guide, was worth more than years of subscriptions to a dozen men.

Recent Technical Publications

THE MINERAL INDUSTRY DURING 1926. Vol. 35. Edited by C. A. Roush. The McGraw-Hill Book Co., 370 Seventh Ave., New York City. Price $12.

The publication of a new volume of "Mineral Industry" is always an event of importance to the mining world. Vol. 35 more than maintains the high standard set by its predecessors. Space does not permit of a detailed description of the full contents of this bulky volume, which contains 860 pages, exclusive of a large index. In the case of every mineral with which it deals, the editors have been at pains to bring our knowledge of treatment processes up to date by including a brief description of the latest developments. In addition to new processes, new plants are mentioned: thus under "Copper," we find a description of the United States Metal Refining Co.'s new reverberatory plant at Carteret, N. J. The last part of the work is, as usual, devoted to mineral and metal statistics for every producing country. These tables have, of course, all been revised and brought up to date, and they thus form a veritable mine of statistical information.

* * *

ABRASIVES—By V. L. Eardley-Wilmot, Canadian Department of Mines, Ottawa. Price 30c.

The first part of the report is devoted entirely to siliceous abrasives such as sandstone, quartz, tripoli, pumice, and volcanic dust. Bulletins to be issued subsequently will deal with corundum and diamond, garnet, and artificial and manufactured abrasives. World production statistics of all classes of abrasives are given in this first volume, and after dealing with grindstones, pulpstones, burr stones, millstones, and chaser stones, Mr. Eardley-Wilmot discusses the raw materials—flint, quartz, and others. The bulletin contains some excellent illustrations, including some fine photomicrographs.

* * *

THE WIRE SAW IN SLATE QUARRYING: PRELIMINARY REPORT. By Oliver Bowles. Reports of Investigations Bureau of Mines. Serial No. 2820.

Waste involved in present methods of quarrying slate led the author to undertake an investigation of the possible application of the wire saw. In collaboration with W. S. Hays, secretary of the National Slate Association, and five Pennsylvania slate companies, the Non-Metallic Minerals Experiment Station carried out exhaustive tests. The tests are described and the conclusions reached are discussed by Mr. Bowles in this preliminary report.

* * *

LIMESTONES OF QUEBEC AND ONTARIO—By M. F. Goudge, Department of Mines, Canada. A preliminary report on the limestones of Quebec and Ontario. Price 25c.

PREVENTING ACCIDENTS IN MINES AND QUARRIES. Published by The Hercules Powder Co., Wilmington, Del. Free on application.

This booklet is a reprint of various "Safety First" articles which have appeared from time to time in *The Explosives Engineer*. Among the contributors are Prof. A. C. Callen, of the University of Illinois, who writes on "Practicing the Spirit of Safety," and W. W. Adams, U. S. Bureau of Mines, who gives a statistical analysis of reports submitted by more than two hundred companies. Accident prevention at Homestake is discussed by C. A. Brooks, the Homestake's safety engineer, and there are many other interesting articles which lack of space makes it impossible to detail. The pamphlet contains many excellent illustrations.

* * *

SOME SAFEGUARDS FOR FIRING BLASTS BY ELECTRICITY. *The Salt Lake Mining Review of* Aug. 30 contains an interesting article by Charles S. Hurter dealing with various measures adopted by large companies using electric blasting to prevent access of stray currents to the firing circuit.

* * *

THE DEVELOPMENT OF GOLD MINING IN CANADA. By C. E. Cole. Paper read before the Empire Mining and Metallurgical Congress and appearing in the Canadian Mining and Metallurgical Bulletin for September. Published by the Canadian Institute of Mining and Metallurgy. Price $1. In this paper the author presents a comprehensive survey of Canada's gold-mining industry. In addition to statistical data Mr. Cole gives a brief outline of the geology, mining and milling practice and plant at such well-known mines as the Engineer Gold mine, in British Columbia, the Premier mine, the Dunwell mine, Hollinger and many others.

RECENT PATENTS

APPARATUS FOR WASHING COAL AND ORE. No. 1,639,915. Aug. 23, 1927. George W. Wilmot, assignor to Wilmot Engineering Co., Hazleton, Pa.

An inclined conveyor belt running in a tank of water with a device to vary the angle at which the stream of water impinges on the material to be washed.

POWER SHOVEL. No. 1,640,055. Aug. 23, 1927. William Sloane, assignor to the Goodman Manufacturing Co., Chicago, Ill.

Poppet valve mechanism in combination with the hydraulic actuating device.

ROCK DRILLING MECHANISM. No. 1,641,451. Sept. 6, 1927. Charles F. Osgood, Claremont, N. H., assignor to Sullivan Machinery Co. A device by which both the operation and the feed of the drill are controlled by a mechanism located at the extreme end of the rotating handle.

PROCESS OF REMELTING CHROMIUM STEEL SCRAP. No. 1,641,326. Sept. 6, 1927. Walter M. Farnsworth, assignor to Central Alloy Steel Corporation, Massillon, Ohio.

Process for the remelting of high-chromium, low-carbon steel scrap to obtain a product having approximately the same chromium and carbon content as the original scrap. This is achieved by the addition of ferrosilicon to prevent the absorption of carbon.

DRIER. No. 1,641,337. Sept. 6, 1927. Gustav Komarek.

A design for a rotary cylindrical drying furnace.

COMPOUND TO SOLDER ALUMINUM. No. 1,641,422. Sept. 6, 1927. George E. Gail, assignor of one-half to Alex Seitz, Wayne County, Mich.

A solder made by melting 9¼ lb. of zinc, pouring this into a chilling fluid, remelting the zinc, and adding 15¼ lb. of tin and then approximately ¼ lb. each of lead and tin phosphide, immersing a block of wood in the melt and finally adding ¼ oz. of pure beeswax for separating the impurities.

MECHANISM FOR OPERATING RECIPROCATING CONVEYORS OR SCREENS. No. 1,641,435. Sept. 6, 1927. Richard S. Jacobsen, Wheaton, Ill.

A design for a head motion.

CRUSHER AND METHOD OF CONSTRUCTING THE SAME. No. 1,641,726. Sept. 6, 1927. John S. Bond, Milwaukee, assignor to the Allis-Chalmers Manufacturing Co., Milwaukee, Wis.

New design for the frame of a gyratory crusher.

SAMPLING APPARATUS AND SYSTEM. No. 1,641,748. Sept. 6, 1927. Clarence G. Dresser, St. Francois, Mo., and Floyd S. Youtsey, Collinsville, Ill.

OXIDATION RESISTING MATERIAL. No. 1,641,752. Sept. 6, 1927. Rudolph F. Flintermann, assignor by mesne assignments to General Electric Co.

A ferrous alloy having an aluminum content of approximately 19½ per cent and from 1 to 5 per cent of titanium.

CRUSHER. No. 1,641,776. Sept. 6, 1927. Ray C. Newhouse, assignor to Allis-Chalmers Manufacturing Co., Milwaukee, Wis.

Design for a gyratory crusher embodying certain new features.

ROLL GRIZZLY. No. 1,641,777. Sept. 6, 1927. Ray C. Newhouse, assignor to the Allis-Chalmers Manufacturing Co., Milwaukee, Wis.

A grizzly formed by a number of revolving rolls fitted with grooves, thus forming openings, so that by the motion of the rolls, material is fed across the grizzly so formed.

ORE FEEDING APPARATUS. No. 1,641,863. Sept. 6, 1927. William Harvey Parsons, Middletown, Calif.

An apparatus for feeding materials through a trough by means of a reciprocating feed arm arranged in the trough and having radial arms.

Personal Notes

CARL O. LINDBERG is now in New York, having just returned from South America.

JOHN M. FOX has moved from Johannesburg, Calif., to 2940 Santa Anita, Altadena, Calif.

K. A. MACPHADYEN has resigned as manager of the Amulet and Area, in the Rouyn area of Quebec.

Dr. S. H. HAUGHTON, of the Geological Survey, Cape Town, recently arrived in Pretoria on a visit to headquarters.

W. H. BLACKBURN, engineer for the Treadwell-Yukon interests, has returned to Tybo, Nev., after an absence in San Francisco.

E. J. RADDATZ, president and general manager of the Tintic Standard Mining Co., has returned from a month's vacation spent at La Jolla, Calif.

S. H. DAVIS, of Baxter Springs, Kan., and T. F. LENNAN, of Joplin, prominent operators of the Joplin-Miami district, returned recently from European trips.

W. F. STAUNTON, vice-president of the Verde Central Mines Co., has taken over active management of the company's properties in the Jerome district.

Lieutenant Colonel J. P. GRENFELL, chairman of the Messina (Transvaal) Development Co., Ltd., who has been visiting the company's copper mine, has returned to England.

ALPHEUS WILLIAMS, general manager of De Beers, is now in Canada. News has been received that he has been promoted to be a Commander of the Venerable Order of the Hospital of St. John.

GEORGE ROGERS, late secretary of Springs Mines (Transvaal), and now of the Broken Hill office of the Anglo-American Corporation of South Africa, Ltd., accompanied by his family, has returned from Johannesburg to Northern Rhodesia.

SHERWIN F. KELLY, assistant manager of Schlumberger Methods in the United States, has left New York for a trip through British Columbia, Washington, California, Arizona, New Mexico and Colorado. He expects to visit the larger cities and mining camps and will return late in October.

J. T. SHIMMIN has resigned his position as superintendent of mills of the Nevada Consolidated Copper Co. and joined the staff of the Southwestern Engineering Corporation as metallurgical and sales engineer, with offices in the Hollingsworth Building, Los Angeles.

C. D. GRIER, accompanied by his wife, sailed from New York on Sept. 16 en route to Johannesburg to resume his duties as African representative of the American Cyanamid Co. Mr. Grier has spent several months in New York and in visiting metallurgical plants in the United States and Canada.

ARTHUR WATTS ALLEN, who has just been appointed editor of *Engineering and Mining Journal*, succeeding J. E. Spurr, was born in England in 1879, and in 1902 graduated from Cambridge University. His first work in the mining field was as cyanide manager and assayer for the British Exploration of Australasia, Ltd., followed by two years in West Australia, as metallurgist. In 1907 he went to Mexico, where he was engaged for three years in cyanide milling work for several companies. Many economies in mill operation,

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notably the use of local grinding media in place of imported flints, and the simultaneous displacement method of vacuum filter operation, resulted from Mr. Allen's work. Going to Uruguay in 1910, he was engaged in similar metallurgical work for a year, and then went to Africa, where he was metallurgist for the Rhodesia Gold Mining & Investment Co. and reduction works manager for the Lonely Reef Gold Mining Co. In 1915 Mr. Allen returned to South America as general manager during the remodeling of the concentrating mill and cyanide plant of the San Juan Mines Co., in Argentina. Following this he was engaged for a time in studying the technology of the Chilean nitrate industry, where he afterward achieved an enviable reputation.

In 1918 he entered the journalistic field, joining the staff of *Engineering and Mining Journal*, leaving a year later to carry on further pioneer work in the nitrate fields of Chile, where he developed the Allen process by which the *caliche* is leached in cold solution. His journalistic work was resumed in 1921, as associate editor of the *Mining and Scientific Press*. This was not interrupted when this magazine was amalgamated with *Engineering and Mining Journal*, as he remained on the Coast as assistant editor of *Engineering and Mining Journal-Press* and *Chemical and Metallurgical Engineering*. His services were again required in Chile last year, however, when he was engaged by Gibbs & Co. for work in the nitrate fields. Mr. Allen, in addition to his wide operating experience in so many different parts of the world, is the author of many articles that have appeared in the technical press and of several more pretentious works. He recently revised Julian and Smart's "Cyaniding Gold and Silver Ores" for the third edition, and, before that, published the "Mill and Cyanide Handbook," the "Recovery of Nitrate From Chilean Caliche," and a "Handbook of Ore Dressing." For several years Mr. Allen has been the author of the chapter on "Hydrometallurgy" in the various Annual Review numbers of this publication.

OBITUARY

SPENCER RUMSEY, chief engineer of the Oliver Iron Mining Co., died recently in Chicago.

J. ROSS CLARK, seventy-six, who, with his brother, the late Senator William A. Clark, of Montana, was identified with numerous mining and other industrial development projects in the West, died in Los Angeles on Sept. 18.

DR. EUGENE ALLEN SMITH, State Geologist of Alabama for fifty-four years, is dead. Dr. Smith was born in 1841. He was educated at the University of Alabama and at Göttingen and Heidelberg. Dr. Smith, in the course of a long and honorable career, had distinguished himself as a teacher, publicist, and writer.

LOUIS JULIUS REYERSBACH died recently at Wittel, Germany, aged fifty-eight. He was for many years connected with the diamond and gold industries in South Africa, being associated with Wernher, Beit & Co. and H. Eckstein & Co. He was for some time chairman of the Rand Mines, Ltd., and was president of the Transvaal Chamber of Mines in 1907.

FRANK C. WIGHT, editor of *Engineering News-Record*, one of the McGraw-Hill publications, who had served that journal and its predecessor, *Engineering News*, in an editorial capacity for twenty-one years, died on Sept. 18 at the age of forty-five. Mr. Wight's entry into the field of technical journalism dated from December, 1906, at which time he became associate editor of *Engineering News*. In 1913 he was promoted to the managing editorship of *Engineering News*, a position which he held until *Engineering News* and *Engineering Record* were consolidated in 1917. Four years later he became managing editor of the consolidated journal, and on Jan. 1, 1924, upon E. J. Mehren's withdrawal from editorial service to devote his time to executive management of the engineering unit of the McGraw-Hill publications, Mr. Wight was made editor of *Engineering News-Record*. This position he held at the time of his death. Mr. Wight was a man of brilliant attainments and remarkably broad understanding and sympathies.

MARKET AND FINANCIAL NEWS

Foreign Zinc Market Continues Dull

The writer of the monthly letter of the International Metal Service, London, correspondent of the American Zinc Institute, discussing world conditions of zinc on Sept. 1, is not inclined to be particularly optimistic. He says:

"After the promise of the last days of July, August has been a disappointment from the market point of view. It will be remembered that there was a fairly optimistic feeling abroad, chiefly engendered by the fact that a substantial revival in the demand for zinc sheets was expected to develop in Germany as a result of increased activity in the building trade. This spurt, however, proved to be short-lived, and it was soon realized that instead of an increased demand a seasonal contraction in takings must be looked for. Thus, although there was no great surplus of metal available and no pronounced selling pressure, it has to be admitted that there are ample supplies of zinc for all probable demands, and that unless there be some curtailment of production stocks must expand slightly over the next few months. Therefore, there is no inducement to consumers to do other than cover their immediate needs nor for speculators to support the market. In such circumstances the quotation has sagged persistently. Indeed, it almost looks as if the price will go somewhat lower, as, in addition to the causes enumerated above, there is also the depressing influence of the lead market to be considered.

"European production shows little signs of expansion, but some signs of a small reduction would be very welcome. The German production is running at around 7,000 metric tons monthly and imports are averaging about 12,000 tons monthly, a much more satisfactory showing than was the case a year ago. Belgium, too, is maintaining her output on what seems to be slightly too high a scale in the present circumstances. Though there is not a superabundance of metal from that quarter offering in England, any contraction in the demands of rollers would of necessity cause more slab zinc to seek an outlet here, and it does not look as if the market could absorb it now.

"The British output for August was about normal at 4,500 tons, and here also the galvanizing trade is fairly well booked for a little while ahead, some of the overseas markets having placed good orders within the last week or so, and being supposed to be not too well covered as regards their requirements of raw material.

"Inasmuch as the Broken Hill companies are producers of zinc as well as lead, it might have been thought that the news that the Proprietary and Block 14 companies would be shutting down within a month would have had some sentimental effect on the market, but the slight rise caused by the cable in question was only momentary and soon lost in the prevailing dullness.

"I am still inclined to hold that the chief cause of the present poor market is the weakness of lead, and as the outlook for the latter metal is the reverse of bright it goes without saying that the chance of any real improvement yet awhile is not good, although the market seems very ready to respond to the stimulus of any better demand, and we shall probably see small bursts followed by relapses throughout the current month.

I estimate world stocks of zinc on Sept. 1 to be as follows, in metric tons:

United States	31,400
Canada	2,800
Australia (including afloat)	2,800
Germany-Poland	7,000
Belgium	3,700
France	1,500
Great Britain	1,600
Scandinavia	200
Far East	600
Elsewhere	1,500
Total	53,100

Dividend Payments by Mining Companies Show Little Change

September dividends show little change compared with June, the corresponding month of the second quarter of the year, if we except the absence of certain special distributions which were a feature of the June list. These included a distribution of half a million dollars by the Federal Mining & Smelting Co., paid on the termination of injunction proceedings, and $900,000 paid out by the United Verde Copper Co. These two disbursements, together with the semi-annual payment of $625,000 made by the Mother Lode Coalition Mines, are in the main responsible for the difference between the July and September totals. To offset these, however, at least in part, is the Keeley Silver Mines, which paid a semi-annual installment of $160,000, and the Amparo company, which operates in the state of Jalisco, Mexico. This company paid a cent per share, calling for a disbursement of $20,000. The Betty O'Neal Mines, a Nevada silver producer, paid out $21,250, being 5c. a share on its issued capital. Tintic Standard again distributes a bonus of 20c. in addition to its normal 20c. quarterly dividend.

Mining Dividends and Yields for September, 1927

Companies in the United States	Situation	Per Share	Total	Per Cent Annual Yield
American Metal	U. S. and Mex.	$0.75 Q	$445,700	7.0
American Metal, pfd	U. S. and Mex.	1.75 Q	87,500	6.4
American Smelting & Refining, pfd	U. S. and Mex.	1.75 Q	875,000	5.3
Betty O'Ne l Mines, s	Nev.	0.05 KS	21,250	...
Bunker Hill & Sullivan, s, l	Idaho	0.75 M	245,250	9.3
Butte & Superior, z, s	Mont.	0.50 Q	145,099	22.2
Calumet & Arizona Mining, c	Ariz.	1.50 Q	964,135	8.6
Calumet & Hecla Consolidated, c	Mich.	0.50 Q	1,002,751	12.6
Eagle-Pic.her Le d, z, l	Okla.	0.40 Q	400,000	6.2
Federal Mining & Smelting, pfd., s, l, z	Idaho, Okla.	1.75 Q	210,000	7.4
Golden Cycle Mining & Red., g	Colo.	0.04 Q	60,000	9.0
Hecla Mining, l, s	Idaho	0.25 Q	250,000	6.6
Homestake Mining, g	S. D.	0 50 M	125.5°0	j9.7
Inland Steel	Minn.	0.625 Q	739,249	4.7
International Nickel, n. c	Ont., W. Va.	0.50 Q	836,692	3.1
Mohawk Mining, c	Mich.	1.00 Q	115,000	9.3
National Lead	U. S.	1.25 Q	387,289	4.1
National Lead, pfd	U. S.	1.75 Q	426,433	6.3
Nevada Consolidated Copper	Nev., Ariz., N. M.	0.375 Q	1,315,959	9.6
Republic Iron & Steel	U. S.	1.00 Q	300,000	5.9
St. Joseph Lead, l, z	Mo., N. Y.	0.75 XX	1,462,821	7.4
Sloss-Sheffield Steel & Iron	Ala.	1.50 Q	150,000	4.7
Tennessee Copper & Chemical	Tenn.	0.125 Q	99,328	5.8
Texas Gulf Sulphur	Texas	1.00 Q	2,540,000	5.8
Tintic Standard, s, l, c	Utah	0.40 Q	461,166	j12.6
U. S. Steel	U. S.	1.75 Q	12,453,411	4.2
Utah Copper	Utah	1.50 Q	2,436,734	4.9
Companies in Other Countries				
Amparo Mining Co., s	Mexico	0.01 KS	20,000	...
Chile Copper	Chile	0.625 Q	2,744,528	7.0
Hollinger Consolidated Gold	Ont.	0.10 F	492,000	7.4
Keeley Silver Mines, Co	Ont.	0.08 SA	160,000	j24.5
Lake Shore, g	Ont.	0.20 X	200,000	...
Lucky Tiger-Combination, g, s	Sonora	0.05 M	35,767	8.9
McIntyre-Porcupine, g	Ont.	0.25 Q	199,500	3.8
Total			32,308,142	

s, silver; l, lead; z, zinc; c, copper; g, gold; n, nickel; t, tin; Q, quarterly; M, monthly; BM, bi-monthly; K, irregularly; F, every four weeks; SA, semi-annually; j, based on dividends for the last twelve months; X, 10c. regular quarterly and 10c. extra; XX, 50c. regular quarterly and 25c. extra; KS, irregular.

Tanganyika Concessions and Union Miniere

For a considerable time Brussels has been the moving factor in price determination of the shares of the Tanganyika Concessions, largely interested in the Union Miniere, the operating company of the Katanga mineral belt, says *The Statist*, London. There is no doubt that the output of the Union Miniere will steadily progress, although, on the other hand, it would not be unreasonable to assume that the grade of ore will be lowered as the new treatment plants come into operation. Hitherto the company has been working high-grade ores, but the supply of such ore is not inexhaustible, and it was for the purpose of utilizing the lower grade of copper-impregnated lodes that the big schemes, which are now approaching completion, were sanctioned. In 1926 the company produced 80,639 tons of copper, at a mining profit of approximately £9 10s. per ton, with copper averaging about £53 per ton, representing a production cost of about £43 10s. to £44 per ton, indicating that a comparatively high grade had been treated. The new large reverberatories are expected to be at work before the end of this year. They will be capable of yielding some 30,000 to 40,000 tons of copper bar annually, so that a gradual advance in the present output figures may be expected. The first unit of the electrolytic leaching plant of 30,000 tons capacity is also progressing, and is expected to be ready for operation in 1929, together with other additions to the treatment and power plants and mine equipment. When these new plants are running the copper production will be about 140,000 tons per annum, after which there will follow two additional leaching units of 30,000 tons each on the Western Mines, supplied with hydro-electric power from the Lufira Falls. While this is encouraging, continues the writer in *The Statist*, it should not be overlooked that after the end of the present year a new division of the profits of the Union Miniere will take place. For the current year the distribution of the net profits of the company, after deduction of all charges, will be as follows: 5 per cent to the legal reserve; 5 per cent of the surplus to directors and staff; 90 per cent to shareholders. But for the financial year ending Dec. 31, 1928, and for every year thereafter, the net profits will be divided as follows: 5 per cent to legal reserve; 5 per cent to directors and staff; 67½ per cent to shareholders (being 75 per cent of balance); 22½ per cent to holders of the preference shares (being 25 per cent of balance), in addition to 6 per cent fixed interest on 150,000,000 francs, which interest is at present debited as intercalatory interest to capital account.

This new allocation of profits means that with the larger output the net proceeds of about 31,500 tons will go to the preference shareholders, while the interest will absorb an amount equivalent to the profit on another 5,700 tons on the basis of £9 per ton profit. It is not to be expected, however, that the profits will be the same from low-grade ore, which will be treated at Panda and Lufira, as those now secured from smelting. What the working costs are likely to be at these plants has never been published, but they have been estimated unofficially at between £35 to £40 per ton of copper, to which has to be added freight and overhead charges. In order to finance the hydroelectric plant at the Lufira Falls a subsidiary company has been formed, the capital of which is 75 million francs in 150,000 shares of 500 francs. In addition there are 100,000 vendor shares which go to the Union Miniere, these shares receiving half the profits after 9 per cent has been paid on the ordinary shares. The Union Miniere receives as remuneration for plans and investigations a sum of 4 million francs in cash and 10,000 ordinary shares. The company has the right to issue debentures up to 25 million francs, the interest on which will be guaranteed by the Union Miniere, as well as a minimum of 6 per cent net on the ordinary shares.

There is little doubt that these arrangements are to the ultimate benefit of the Union Miniere, although at the same time their immediate effect may be to diminish the profit divisible among shareholders. Until it is seen what actually happens when these obligations have to be met, the outlook seems to be somewhat indefinite. The profits made by the Tanganyika Concessions during the last two years have been mainly derived from sales, opportunities largely created by issues made by the Union Miniere, and which cannot be expected to be repeated. The dividends declared on the company's holdings in the Union Miniere represented £258,000 in 1924, £155,000 in 1925, and £189,000 in 1926, the latter being the sum that may be credited in the accounts of the Tanganyika company for the current year, and the receipt of which has allowed of an interim dividend of 5 per cent being paid on the shares, which absorbs approximately £225,000.

Latest Statistics Show Increase in World's Silver Output

The most recent available figures issued by the American Bureau of Metal Statistics show a considerable increase in silver production for June. The output of that month, 18,784,000 oz., was the high point of the year. It will be seen from the table that this was largely accounted for by increased Mexican production.

World's Production of Silver (Thousands of Fine Ounces)

1927	U.S.	Canada	Mexico	Bolivia	Peru	Australia	Burma	Totals
January	5,196	1,459	8,559	315	1,481	713	408	18,131
February	4,979	1,733	6,930	315	1,067	700	425	16,149
March	5,104	1,525	8,332	306	1,061	641	504	17,473
April	4,712	1,716	7,737	319	1,102	840	465	16,891
May	4,811	1,393	7,791	478	1,336	973	479	17,261
June	4,931	1,614	9,212	400 (*f*)	1,306	847	474	18,784
July	4,838	1,752	(*d*)	(*d*)	1,513	957	483	(*d*)
August	5,036	1,549	(*d*)	(*d*)	1,398	966	(*d*)	(*d*)
Totals	39,607	12,741	(*d*)	(*d*)	11,600	6,637	(*d*)	(*d*)

(*d*) Not yet available. (*f*) Partly estimated.

Refined Arsenic Situation Statistically Good

The figures of production and stocks given below were issued by the American Bureau of Metal Statistics. They show a satisfactory position which might well indicate increased demand in the near future, especially in view of the activities of the boll weevil mentioned in a recent *Engineering and Mining Journal* editorial.

1927 Month	Total U. S. Production Tons	Stock at End Tons
January	913	1,983
February	810	2,251
March	1,030	2,230
April	925	2,059
May	683	1,718
June	789	1,266
July	765	789
	5,915	

The production of crude arsenic during the same period was 8,087 tons and stocks at the end of July amounted to 1,363 tons.

Rhodesian Chrome Exports Increase

For the first seven months of the current year the chrome ore exports from Rhodesia totaled 164,396 long tons as compared with a total of 181,194 for the whole year in 1926. These figures indicate that an increase of 30 per cent in 1927 over the 1926 figures may reasonably be expected.

Cyprus Increases Asbestos Production

Speaking at the annual general meeting of the Cyprus Asbestos Co., Ltd., the managing director, F. C. Jenkins, said that the output of asbestos in Cyprus, already double that of last year, was expected to reach 12,000 tons a week before the end of the season.

Lead Ore Received by Mexican and U. S. Smelters

The total receipts of lead in ore by United States and Mexican smelters during the year has been as follows:

	By U. S. Smelters Tons	By Mexican Smelters Tons	Total by U. S. and Mexican Smelters Tons
January to July 1927 (inclu)	408,541	138,516	547,057
Year 1926	731,484	202,693	934,177

CALUMET AND ARIZONA reports copper production for August, 1927, as follows: Calumet and Arizona, 5,154,000 lb.; New Cornelia, 6,077,960 lb.

The Market Report

Copper Market Active at 13¼c.; Lead Sales Also Improve

New York, Sept. 21, 1927—A much larger business in copper, with all sellers participating at 13¼c. delivered in the East, has been the feature in the non-ferrous metal markets in the week ending today. Lead has also sold in improved volume, and the St. Louis price has advanced to 6.075c. Silver shared in the stronger tone, reaching 56⅛c. on Monday. Zinc and tin, however, have been quiet and slightly lower in price than last week.

Copper Firmer

The large producers, who have been holding their copper at 13¼c., delivered Connecticut, for over a month without placing much business, finally brought buyers around to their way of thinking this week, and the sales have been the largest for any week since June 1. In the East, 13¼c. was generally realized, with a fair amount of business in the Middle West at 13⅜c. Thursday and Friday were the largest days, but business has been well over 1,000 tons a day for the last three days as well. However, yesterday and today there has been more of a disinclination to pay the full price quoted earlier in the week, substantial amounts being booked in limited directions at 13.20c. basis. Buying has been general among brass, sheet copper, and wire mills, and has been largely for October shipment. A little November has, however, been in demand, and an occasional request for prompt. Foreign sales are now about normal for this time in the month, the export association's price continuing at 13½c., c.i.f.

Daily Prices of Metals

Sept.	Copper	Tin		Lead		Zinc
	Electrolytic, N. Y.	99 Per Cent	Straits	N. Y.	St. L.	St. L.
15	13.025	61 75	62.00	6 25@6.30	6 00	6 25@6 275
16	13 025	61 75	62 00	6.25	6.00	6.275
17	13 025	61 75	62 125	6.25@6 30	6 075	6 25
19	13.025	61 375	61.625	6 25	6.05@6.075	6.25
20	12 975@13 025	60 75	61.500	6 25	6.075	6.20@6.25
21	12 975@13 025	60 375	60.75	6 25	6.075	6 20@6.225
	13.017	61 292	61.667	6 258	6 048	6 246

Average prices for calendar week ending Sept. 17, 1927, are: Copper, 12.983; 99 per cent tin, 61.688; Straits, 62.104; N. Y. lead, 6.258; St. Louis lead, 6.013; zinc, 6.258; and silver, 55.457.

The above quotations are our appraisal of the major markets for domestic consumption based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis, as noted. All prices are in cents per pound.

Copper, lead, and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

In the trade, copper prices usually are quoted on a delivered basis; i.e., delivered at consumer's plant. As delivery and interest charges vary with the destination, the figures shown above are net prices at refineries on the Atlantic seaboard. Delivered prices in New England average 0.225c. per pound above those quoted, and prices at so-called Middle West destinations, 0.325c. above.

Quotations for copper are for ordinary forms of wire bars, ingot bars, and cakes. For ingots an extra 0.05c. per pound is charged and there the other extras for other shapes. Cathodes are sold at a discount of 0.125c. per pound.

Quotations for zinc are for ordinary Prime Western brands. Zinc in New York is now quoted at 0.35c. per pound above St. Louis, this being the freight rate between the two points.

Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

London

Sept.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3M		Spot	3M	Spot	3M	Spot	3M
15	54 15/16	55 7/16	62¼	286	281	21 13/16	22⅜	27⅝	27⅝
16	55 1/16	55 9/16	62¼	285¼	279½	21 13/16	22⅜	27¾	27⅝
19	55⅛	55 11/16	62¼	284¾	278¾	21 15/16	22½	27 7/16	27 7/16
20	54¾	55 3/16	62¼	279¾	276	21 11/16	22 3/16	27 5/16	27 5/16
21	54 11/16	55⅛	62¼	278¾	274¾	21½	22	27⅛	27⅛

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver, Gold, and Sterling Exchange

Sept.	Sterling Exchange "Checks"	Silver		Gold London	Sept.	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
15	4.85¾	55⅜	25½	84s11½d	19	4.86	56⅛	25 7/16	84s11½d
16	4.85¾	55½	25⅝	84s11½d	20	4.86⅛	55⅝	25⅝	84s11½d
17	4.86	55⅝	25 11/16	84s11½d	21	4.86	55⅞	25¾	84s11½d
					Avg.		55.688		

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London silver quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command three-eighths cent premium.

Better Lead Sales

The week has witnessed better business in lead, leading to an improved tone in the St. Louis market toward the end of the week. Thursday, Friday, and Monday all saw business in good volume. This had the effect of bringing the St. Louis price up to 6.075c. The New York sales have also improved, and a feature of the week has been the interest displayed by every class of buyer. Battery manufacturers have been among those inquiring for the metal, and in some quarters this is regarded as a favorable indication, owing to the fact that inquiries from this branch of industry have been subnormal for some time. Notwithstanding the better volume of sales and the firmer undertone which is perceptible, the New York market price has not risen to correspond with the St. Louis quotation; the foreign market does not appear strong enough to warrant an increase in lead prices here. In many quarters not only is no rise in price expected, but uncertainty is expressed as to whether 6.25c. New York is rock bottom. Over-supply, a drop in London prices, and a certain weakness of other non-ferrous metals are quoted as good reasons for not anticipating any rise in price. At the same time everything points to consumers being fairly willing to take a further interest at present quotations; sales still continue to be for prompt and early October shipment in the vast majority of cases.

Zinc Neglected

Galvanizers have shown but little interest in zinc this week. Until yesterday, 6¼c., St. Louis, was generally realized, with an occasional carload at slightly higher prices, but in the last day or two zinc has been procurable as low as 6.20c. Producers, however, are not inclined to cut prices further until the ore market drops. The general position seems weak.

Tin Weak

Tin has been declining steadily, and even at the present low prices sales are not being made in any quantity. Slackness in the tin-plate trade has led to

considerable decrease in demand, and lower prices are adumbrated in some quarters.

Silver Steady at 55⅞c. on Sept. 21

During the last week the silver market reached a higher level, until 56⅛c. was quoted on Sept. 19. Good buying for China account against sales of Japanese yen and occasional orders from India had a steadying effect on the market up to this period, but on Sept. 20 it was reported that operators in China reversed their position, and quotations reacted to 55⅝c., and closed steady today at 55⅞c.

Mexican Dollars (old Mexican pesos) —Sept. 15th, 41⅞c.; 16th, 42c.; 17th, 42⅛c.; 19th, 42⅝c.; 20th, 42⅛c.; 21st, 42⅛c.

Foreign Exchanges Steady

Only fractional changes have occurred in the principal foreign exchanges. Closing cable quotations on Tuesday, Sept. 20, were: francs, 3.92⅜c.; lire, 5.45¼c.; and marks, 23.81⅛c. Canadian dollars, 1/16 per cent premium.

Other Metals

Quotations cover large wholesale lots unless otherwise specified. London prices are according to latest mail advices.

ALUMINUM—Per lb., 98 or 99 per cent grade, price of leading interest, 26c.; outside market, 25.30@25.80c.

ANTIMONY—Per lb., duty paid. New York: Chinese brands, range for the week, spot business, 10¾@11c. Market quiet. Cookson's "C" grade, spot, 17¾c. Needle antimony nominally 8c. for lump and 10c. for powdered. White oxide, 16½c.

BISMUTH—Per lb., New York, in ton lots, $1.85@$2.10. London, 8s.

IRIDIUM—Per oz., $106@$110 for 98 @99 per cent sponge and powder. Market dull.

NICKEL—Per lb. ingot, 35c.; shot, 36c.; electrolytic, 39c. (99.75 per cent grade) for single lots of spot metal.

PALLADIUM—Per oz., $52@$54. Small lots bring up to $58. Market dull and prices nominal. Pure metal as a constituent of crude platinum, nominal.

PLATINUM—Official price quoted by the leading interest on small miscellaneous orders for refined metal, per oz., $72. Dealers and refiners quote the trade for refined metal, per oz., cash, $64.50@$66.

QUICKSILVER—Per 76-lb. flask, range for week $119@$120, nominal. Market shows little life. San Francisco wires $120.67. London, £21¾@£22.

Prices of Cadmium, Cobalt, Germanium Oxide, Lithium, Magnesium, Molybdenum, Monel Metal, Osmium, Radium, Rhodium, Ruthenium, Selenium, Tantalum, Tellurium, Thallium, Tungsten, and Zirconium are unchanged from the issue of Sept. 3.

Metallic Ores

MANGANESE ORE—Per long ton unit of Mn. c.i.f. North Atlantic ports, minimum 47 per cent Mn, 36@38c. Caucasian, washed, 53@55 per cent, 40c. Chemical grades unchanged from quotations in the Sept. 3 issue.

TUNGSTEN ORE—Per unit of WO_3, N. Y.: Wolframite, $10.15@$10.25. Western scheelite, $10.50@$10.75. Market somewhat more active.

Chrome, Iron, Molybdenum, Tantalum, Titanium, Uranium, and Vanadium Ores are unchanged from quotations in the Sept. 3 issue.

Lead Ore Steady— Zinc Ore Lower

Joplin, Mo., Sept. 17, 1927

Blende	Per Ton
High	$44.60
Premium blende, basis 60 per cent zinc	$42.00@ 43.00
Prime Western, basis 60 per cent zinc	40.00@ 41.00
Fines and slimes, basis 60 per cent zinc	36.00@ 39.00
Average settling price, all zinc	41.39
Galena	
High	$85.00
Basis 80 per cent lead	80.00
Average settling price, all lead	84.39

Shipments for the week: Blende, 15,199; lead, 1,055 tons. Value all ore the week, $718,180.

Buyers finished filling orders early today on a basis reduced one dollar per ton from last week. There was 12,900 tons purchased, on a basis of net dry weight. Moisture deductions and the overloading capacity of freight cars will add 15 per cent to this figure, approximating a total of 14,800 tons. As this is about 800 tons less than the output, a small increase in stocks will result.

The American Metal Co.'s Blackwell smelter of 9,600 retort capacity is likely to be closed down soon on account of gas shortage. The company's ore-buying office in Joplin will be retained with one man in charge, as there is yet enough gas in the Blackwell field to continue a part of the works. Zinc flotation concentrates from the company's Pecos mill in New Mexico are being shipped to Langeloth, Pa. The American Metal Co. has been gradually decreasing its ore purchases in this district since last April so that recently monthly purchases have been only about 1,000 tons.

Platteville, Wis., Sept. 17, 1927.

Zinc Blende	Per Ton
Blende, basis 60 per cent zinc	$44.75
Lead Ore	
Lead, basis 80 per cent lead	$80.00

Shipments for the week: Blende, 1,394 tons; lead, none. Shipments for the year: Blende, 48,057; lead, 1,250 tons. Shipments for the week to separating plants, 2,273 tons blende.

Non-Metallic Minerals

Amblygonite, Asbestos, Barytes, Bauxite, Borax, Celestite, Chalk, China Clay, Diatomite, Emery, Feldspar, Fluorspar, Fuller's Earth, Garnet, Gilsonite, Graphite, Greensand, Gypsum, Iron Oxide, Lepidolite, Limestone, Magnesite, Mica, Monazite, Ocher, Phosphate, Potash, Pumice, Pyrites, Quartz Rock Crystal, Silica, Spodumene, Sulphur, Talc, Tripoli, and Zircon are unchanged from prices in the Sept. 3 issue.

Mineral Products

ARSENIOUS OXIDE (White Arsenic) —Per lb., 4c. Market slack. London, Cornish white, per long ton, £18.

Calcium Molybdate, Copper Sulphate, Sodium Sulphate (Salt Cake), Sodium Nitrate, and Zinc Oxide are unchanged from prices in the Sept. 3 issue.

Ferro-Alloys

FERROMANGANESE—Per long ton, domestic and foreign, 78@82 per cent, $90, f.o.b. furnace, for delivery during second half 1927. Spiegeleisen, 19@21 per cent, $33@$35 f.o.b. furnace.

FERROTUNGSTEN—Per lb. of W contained, 75@80 per cent, 93@96c. f.o.b. works. Dull.

Ferrocerium, Ferrochrome, Ferromolybdenum, Ferrophosphorus, Ferrosilicon, Ferrotitanium, and Ferrovanadium are unchanged from prices in the Sept. 3 issue.

Metal Products

ROLLED COPPER—Per lb., f.o.b. mill, sheets, 22c.; wire, 15¼c.

LEAD SHEETS — Full rolled 10c.; clipped 10¼c. per lb.

Nickel Silver, Yellow Metal, and Zinc Sheets unchanged from prices in Sept. 3 issue.

Refractories

Chrome Brick, Fireclay Brick, Magnesite Brick, Silica Brick and Zirkite are unchanged from quotations in the Sept. 3 issue.

Steel Demand Slackens

Pittsburgh, Sept. 20, 1927

Demand for steel has dropped another notch in the last fortnight, and allowing for seasonal variation, is at a slightly lower level than at any time since the brief slump of 1924. No conspicuous decrease is evident in any one quarter.

Though there are no quotable changes in finished-steel prices, more irregularities are noted week by week. There has been fresh shading in bars, shapes, and plates of the 1.90c., Chicago, price, and doubt is entertained as to the stability of 1.80c., Pittsburgh, as minimum in this territory.

Pig Iron—The nominal quotation of $17.25, Valley, on basic iron is displaced by a definite quotation of $17, a steel interest having sold about 6,000 tons at the price. Bessemer remains at $18 and foundry at $17.50, Valley, but a further decline in foundry seems imminent if any important inquiry appears.

Connellsville Coke — Demand continues poor except for a fair inquiry for heating coke. Spot prices are maintained, and no more, at $3@$3.25 for furnace and $4@$4.75 for foundry coke.

Current Prices of Mining Supplies

Rise and Fall of the Market

TRACK supplies are higher than a month ago at mills and warehouses. Prices of steel structurals are also firmer with no actual advance in quotations. The range of $1.75 to $1.85 per 100 lb. applies on the principal hot-rolled steel products, base, Pittsburgh. The lower figure is for lots involving several carloads; single car lots or less, bring 10c. per 100 lb. more. Trend is downward in c-i. pipe, mine timbers, nails, cement, lime, linseed oil, zinc dust and litharge.

SHEETS—Quotations are per 100 lb. in various cities from warehouse, also the base quotations from mill:

	Pittsburgh, Large Mill Lots	St. Louis	Chicago	San Francisco	New York
Galvanized No 24	$3 85	$5.25	$4 80	$5.45	$4 95

STEEL RAILS—The following quotations are per gross ton f.o.b. Pittsburgh, Chicago and Birmingham for carload or larger lots:

	Pittsburgh—Current	Pittsburgh—One Year Ago	Birmingham	Chicago
Standard bessemer rails	$43.00	$43.00	$43 00	$43 00
Standard openhearth rails	43.00	43.00	43.00	43 00

TRACK SUPPLIES—The following prices are base per 100 lb. f.o.b. Pittsburgh for carload lots, together with the warehouse prices at the places named:

	Pittsburgh—Current	Pittsburgh—One Year Ago	Chicago	St. Louis	San Francisco	Birmingham
Standard spikes, ⅝-in. and larger	$2 80–$2 90	$2 80–$2 90	$3 55	$3 65	$3 85	$3 00
Track bolts	3 90– 4.25	3.90@4.25	4.55	4.60	5.35	3.90
Standard section angle bars, splice bars or fish plates	2.85	2.75	3.40	3.75	4.25	2.95

STRUCTURAL MATERIAL—Following are base prices per 100 lb. in carload lots, f.o.b. mill, Pittsburgh and Birmingham. At other cities listed, quotations apply on less-than-carload lots, from warehouses.:

	Pittsburgh, Mill	Birmingham Mill	New York	Dallas	St. Louis	Chicago	San Francisco
Beams, 3 to 15 in.	$1.75@1.85	$2.05	$3.34	$4.10	$3.25	$3.10	$3 10
Channel, 3 to 15 in.	1.75@1.85	2.05	3.34	4.10	3.25	3.10	3.10
Angles, 3 to 6 in., ¼ in. thick	1.75@1.85	2.05	3.34	4.10	3.25	3.10	3 10
Tees, 3 in. and larger	1.75@1.85	2.05	3 34	4.10	3.35	3 10	3 10
Plates ¼-inch thick	1.75@1.85	1.95	3.34	4.10	3.25	3 10	3.10

WIRE ROPE—Discounts from list price, f.o.b. New York and east of Missouri River, on regular grades of bright and galvanized are as follows:

Cast steel round strand rope	20%
Galvanized steel rigging and guy rope	7½%
Round strand iron and iron tiller	5%
Plow steel round strand rope	35%
Special steel round strand rope	30%
Galvanized iron rigging and guy rope	12½%

	New York	Cleveland	Chicago
DRILL ROD (from list)	60%	55%	50%

WROUGHT IRON AND STEEL PIPE—The following discounts from list, are to jobbers for carload lots at Pittsburgh mill:

	Steel Inches	Steel Black	Steel Galv.	Iron Inches	Iron Black	Iron Galv
BUTT WELD—	1 to 3	62	50½	1 to 1¼	30	13
LAP WELD—	2½ to 6	59	47½	3 to 6	28	13

WROUGHT-STEEL PIPE—From warehouses at the places named the following discounts from list hold for steel pipe:

	Black—New York	Black—Chicago	Black—St. Louis
2½ to 6 in., lap welded	48%	51%	46%

CAST-IRON PIPE—The following are prices on class B, per net ton, for carload lots:

	New York—Current	New York—One Year Ago	Birmingham	Chicago	St. Louis	San Francisco
6 in. and over	$44.60	$52.60@53.60	$38.00	$40.20	$40.60	$43.00

NUTS—Hot pressed or cold punched, square or hexagonal, blank or tapped, full kegs or cases, discount 50-10% from new list April 1, 1927 at warehouses in New York and vicinity.

HOLLOW TILE—Price per block in carload lots, f.o.b., to contractors, for hollow building and partition tile.

	New York—Current on Trucks‡	New York—One Year Ago	Chicago	Philadelphia	St. Louis	San Francisco‡	Perth Amboy N. J., Factory
4x12x12	$0.1027	$0.1112	$0.076	$0.105	$0.068	$0.108	.....
6x12x12	.1541	.1667	.104	...	.09	.156	$0.2388*
8x12x12	.1926	.2084	.142	.21	.126	244	.2956†

* 10x12x12; † 12x12x12. ‡ Partition tile.

MACHINE BOLTS—Square heads and nuts, up to 1x30-in., full kegs or cases discount 50% from new list April 1, 1927 at warehouses in New York and vicinity.

LUMBER—Prices wholesale, per M ft. b.m., in carload lots, f.o.b. **San Francisco**—At yards, rough Douglas fir, No. 1 common:

	6-8 and 12 Ft.	10-16-18 and 20 Ft.	22 and 24 Ft.	25 to 32 Ft
3x3 and 4	$26.00	$27 00	$28 00	$31.00
3x6 and 8	26.00	27 00	28 00	31.00
4x4-6 and 8	26 00	27 00	28.00	31 00

New York—Prices are for long-leaf yellow pine timbers (rough) to dealers f.o.b steamer rail. Price to contractors, delivered to job, is $5@$10 additional:

	New York—20 Ft and Under	New York—22-24 Ft.	Chicago—Up to 20 Ft., Pine	Chicago—Up to 32 Ft., Fir*
3x4 to 8x8	$43.00	$44 00	$38 00	$38 50
3x10 to 10x10	50.00	51.00	45 00	38.50
3x12 to 12x12	57.00	58.00	54.00	38.50

Other Cities—Price for rough timbers: 8 x8-In. x 20 Ft. and Under — 12 x 12-In ‡ 20 Ft and Under

	Pine	Fir*	Hemlock Spruce	Pine	Fir*
Boston	$47.75	$47 50†	$49.00 $52.00	$57 50	$57 00
Cincinnati	37.00	...	...	48 00	....
Denver	...	33 25	34 25 34 25	...	34 25
Minneapolis	42 50	38 75	34 50	47 00	39 75
Kansas City, Mo.	41 50	39.75	...	55 50	40 25
Philadelphia	48 00	36 00	38 00 45.00	62.00	36.00

*Douglas fir. †Prime. ‡3x12 to 12x12 Chicago S4S.

NAILS—The following quotations are per keg from warehouse:

	Pittsburgh, Mill	Chicago	San Francisco	Dallas	St. Louis	Montreal
Wire	$2 55	$2 95	$3 25	$4 25	$2 83	$4 95
Cut	2.80	...	5 00	5 00	2.95	5.00

PORTLAND CEMENT—Prices to contractors per bbl. in carload lots *without charge for bags.* Cash discount not deducted.

	Current	One Month Ago	One Year Ago
New York, del. by truck	$2 35	$2.35 2.50	$2.50@2 60
Chicago, f.o.b.	2 05	2.05	2.10
Cleveland, f.o.b.	2 24	2 24	2.29

LIME—Warehouse; New York quotes bbl. 280 lb. net; Chicago, 180 lb.:

	Hydrated, per Ton Finishing	Hydrated, per Ton Common	Lump, per Barrel Finishing	Lump, per Barrel Common
New York	$17 45	$9 75	$3.50	$2.10@$2 35
Chicago	20 00	18 00	....	1.50

LINSEED OIL—These prices are per gallon:

	New York—Current	New York—One Year Ago	Chicago—Current	Chicago—One Year Ago
Raw in barrel (5 bbl. lots)	$0.86½	$0.95½	$0.81	$0.92

WHITE AND RED LEAD—In 100-lb. kegs, base price in cents per pound:

	Dry—Current	Dry—1 Yr. Ago	In Oil—Current	In Oil—1 Yr. Ago
Red	13 75	15 25	15 25	16.75
White	13.75	15 25	13 75	15.25

HOSE—Quotations at New York warehouses:

Fire Protection: Underwriters' 2½-in. coupled, single jacket (net). 50-Ft. Lengths $0.68 per ft

Air—Best Grade: ½-in., per ft. 3 ply $0.34 4 ply $0.42

Steam—Discounts from List: First grade 40% Second grade 40–5% Third grade 50%

RUBBER BELTING—List price 6-in., 6 ply, $1.83 per lin.ft. for rubber transmission belting. Discounts from list are as follows: Best grade 50% Second grade 50–10%

LEATHER BELTING—List price, 24c. per lin.ft. per inch of width for single ply at New York warehouses:

Grade	Discount from list
Medium	40–5%
Heavy	30–10%

PACKING—Prices per pound at New York warehouse:

Rubber and duck for low-pressure steam, ¼ in.	$0.95
Rubber sheet	50
Rubber sheet wire insertion	80

MANILA ROPE—Per lb., ¾-in. and larger, 1,200-ft. coils

Atlanta	$0.27	New Orleans	$0 21
New York	.25	Seattle	.23
Chicago	23	San Francisco	.22½

EXPLOSIVES—Prices per pound of dynamite in small lots:

	Gelatin—40%	Gelatin—60%
New York	$0.265	$0.2875
Minneapolis	.1917	.2123
Denver	.2025	.2275
Seattle	.165	.19
Cincinnati	.22	.245
San Francisco	.1625	.1925

FLOTATION OIL—Pine tar, 50 gal. bbl., gross weight 500 lb., f.o.b. New York, carload lots, per gal. $0.35

CHEMICALS—Prices for round lots in New York market, per lb.:

Zinc dust, 550 lb. casks	$0.09@.10
Litharge, casks	09
Sodium cyanide, 220 lb. single case lots	18@.22
Calcium carbide, in drums	05@.06

Mining Stocks—Week Ended Sept. 17, 1927

Stock	Exch.	High	Low	Last	Last Div.
COPPER					
Anaconda	New York	49⅜	46¼	49	Jy.16, Au.22 Q 0.75
Arcadian Consol.	Boston	...	...	*75	...
Ariz. Com'l	Boston	7⅛	5⅛	7	Jy. 18, Jy. 30 0.25
Calaveras	N. Y. Curb	...	...	1⅜	...
Calumet & Arizona	New York	76	70	74¾	Se. 9, Se. 26 Q 1.50
Calumet & Hecla	Boston	17½	15½	17	Au. 31, Se.15 Q 0.50
Cerro de Pasco	New York	68	64½	66¼	Jy.14, Au.1 Q 1.00
Chile Copper	New York	37½	35⅞	37	Se. 2, Se. 30, Q 0.62½
Con. Coppermines	N. Y. Curb	3¼	2⅞	3⅛	...
Copper Range	Boston	18	13¼	17¼	Ap.2, My.2, A 1.00
Crystal Copper	BostonCurb	*34	*30	*31	...
East Butte	Boston	2	1¼	2	Dec., 1919 0.50
Granby Consol	New York	37¼	34½	37	Jn.15 Jy. 1 Q 1.00
Greene Cananea	New York	75	59¼	72⅛	Nov., 1920 0.50
Howe Sound	New York	39⅞	38	39½	Jy.1, Jy.15, Q 1.00
Inspiration Consol	New York	19⅞	16½	18⅜	Ma.17, Ap.4, Q 0.25
Iron Cap	Boston Curb	2¼	1⅞	1⅞	...
Isle Royale	Boston	15	10½	14	Se. 30, Oc. 15, Q 0.50
Kennecott	New York	77¼	72⅝	76	Se. 2, Oc. 1, Q 1.25
Magma Copper	New York	42⅞	36⅜	42⅜	Se.30,Oc.15 Q 0.75
Mason Valley	N. Y. Curb	*88	*68	*88	...
Miami Copper	New York	15⅛	14⅜	15⅛	Au 1, Au.15, Q 0.37½
Mohawk	Boston	47	43½	46	Jy.31, Se.1 Q 1.00
Mother Lode Coal	New York	2⅜	2⅛	2⅛	Jn.19, Jn.30 0.25
Nevada Consol	New York	17⅜	15¼	17	Se. 16, Se. 30 Q 0.37½
New Cornelia	Boston	22⅞	21¼	22⅜	Au.5, Au.22 Q 0.50
Noranda	N. Y. Curb	24¼	24	24⅛	...
North Butte	Boston	1⅜	1¼	1⅜	Oct., 1918 0.25
Ohio Copper	N. Y. Curb	1 1/16	1	1¼	Sept. 1926 0.03
Old Dominion	Boston	13⅜	10⅜	13⅜	Dec., 1918 1.00
Phelps Dodge	N. Y. Curb	122	122	122	Jn.18, Jy.1 Q 1.50
Quincy	Boston	18⅛	15⅛	17	March, 1920 1.00
Ray Consolidated	New York	15⅛	15⅛	15⅛	Ap.20, Ap. 30 0.25
St. Mary's Min. Ld.	Boston	25	21	24	Fe.10, Ma.10 2.00
Seneca Copper	New York	1⅜	1⅛	1⅛	...
Shattuck Denn	Boston Curb	4¼	4⅛	4⅛	...
Tenn. C. & C	New York	9⅜	8½	9⅛	Au.31,Se.15, Q 0.12½
United Verde Ex	N. Y. Curb	25	23⅞	24⅛	Jy.6, Au 1 Q 0.75
Utah Copper	New York	130	130	130	Se. 16, Se. 30 Q 1.50
Utah Metal & T	Boston	1	*99	1	Dec., 1917 0.30
Walker Mining	Salt Lake	*52	*52	*52	...
NICKEL-COPPER					
Internat. Nickel	New York	68⅛	64	66⅞	Se. 16, Se. 30 Q 0.50
Internat. Nickel pfd.	New York	108⅛	108⅛	108¼	Ap. 14, My. 2 Q 1.50
LEAD					
Gladstone Mtn.	Spokane	*14½	*13	*13	June, 1927 0.005
National Lead	New York	129	122⅛	128	Se. 16, Se. 30 Q 1.25
National Lead pfd.	New York	136	135⅛	135½	Se.1, Se. 30 Q 1.75
St. Joseph Lead	New York	41	40⅛	41	Se.10,Se.20, QX 0.75
ZINC					
Am. Z. L. & S.	New York	7⅛	7	7	May, 1917 1.00
Am. Z. L. & S. pfd.	New York	38	36¼	36¼	Nov., 1920 1.50
Butte C. & Z.	New York	4⅛	4	4⅛	De. 9, De. 24 0.50
Butte & Superior	New York	9⅛	8⅛	9⅛	Se. 16, Se. 30 Q 0.50
Callahan Zn-Ld	New York	1⅝	1⅛	1⅛	Dec., 1920 0.50
Consol.Lead&Zinc'A'	St. Louis	12⅞	12⅛	12⅛	Ma.15, Ap.1 Q 0.25
Eagle-Picher	Cincinnati	25⅞	24⅝	25	Au.15, Se.1 Q 0.40
Eagle-Picher pfd.	Cincinnati	...	...	117½	Jn.30, Oc.15 Q 1.50
New Jersey Zn.	N. Y. Curb	187½	186	186	Jy.20,Au.10 QX 2.00
United Zinc	N. Y. Curb	...	...	*55	...
Yellow Pine	Los Angeles	...	...	*37½	Dec. 1925 Q 0.04
GOLD					
Alaska Juneau	New York	1⅞	1⅞	1⅞	...
Argonaut	Toronto	*47	*34	*45	...
Barry-Hollinger	Toronto	*75	*40	*74	...
Con.W.Dome L.new.	Toronto	*10½	*9	*10	...
Cresson Consol. G.	N. Y. Curb	2⅛	2	2	Se. 30, Oc.10 Q 0.10
Dome Mines	New York	11⅛	8⅛	8¾	Se.30, Oc.20 Q 0.75
Golden Cycle	Colo.Springs	†1.79½	†1.78	...	Au.30, Se.10 Q 0.04
Hollinger Consol.	Toronto	18.40	17.50	17.85	Se. 21, Oc. 7 F 0.10
Homestake Mining	New York	...	...	613¾	Se.20, Se. 26 M 0.50
Kirkland Lake	Toronto	2.36	2.10	2.33	...
Lake Shore	Toronto	25.00	24.50	24.95	Se.1, Se. 15 X 0.20
McIntyre-Porcupine	New York	26½	26½	26½	Au.1, Se.1 Q 0.25
Portland	Colo.Springs	†*31	†*28	...	Ap.6, Ap.15, Q 0.02
Rand Mines	New York	...	...	48¼	Au.22-29 Am.Sh.1.52
Teck-Hughes	Toronto	9.40	9.15	9.24	Jy.21, Au.1 0.10
Tom Reed	Los Angeles	*47½	*46½	*46½	Dec., 1926 0.02
Tough-Oakes	Toronto	*35	*30	*32	...
United Eastern	N. Y. Curb	...	...	*35	July, 1924 0.05
Vipond Cons	Toronto	*67	*58	*66	Apr.1, Apr.15 0.03
Wright-Hargreaves	Toronto	7.60	7.45	7.48	Jy.15, Au.1 SA 0.05
GOLD AND SILVER					
Carnegie Metals	Pittsburgh	13⅜	13	13	...
Con. Cortez	N. Y. Curb	*19	*18	*19	...
Con. Virginia	San Francisco	*10½	*9¼	*9½	...
Dolores Esperanza	N. Y. Curb	...	...	*50	July, 1923 0.05
Premier Gold	N. Y. Curb	2¼	2¼	2¼	Se.15, Oc. 4 0.08
Tonopah Belmont	N. Y. Curb	1 1/16	1	1 1/16	Ma.15, Ap.4 0.08
Tonopah Extension	N. Y. Curb	...	...	*51	Apr. 1925 0.05
Tonopah Mining	N. Y. Curb	2¼	2¼	2¼	Ma.31, Apr.21 0.07½
West End Consol.	N. Y. Curb	...	...	*7	Mar., 1923 0.05
Yukon Gold	N. Y. Curb	...	...	*45	June, 1918 0.02
SILVER					
Beaver Consol	Toronto	1.75	1.59	1.75	May, 1920 0.03
Castle-Trethewey	Toronto	*12¾	*12	*12½	...
Coniagas	Toronto	4.90	4.50	4.50	May, 1924 0.12½
Keeley	Toronto	*80	*71	*75	Se.1, Se.15 0.08
Lorrain Trout Lake	Toronto	*60	*60	*60	July, 1925 0.05
McKinley-Dar.-Sav.	Toronto	*15¾	*15¼	*15¼	Oct., 1920 0.03
Mining Corp. Can.	Toronto.	3.15	3.03	3.08	Jn. 29, Jy.15 0.12½
Nipissing	N. Y. Curb.	6⅜	5⅜	6	Se.30, Oc.20 Q 0.07½

Stoc	Exch.	High	Low	Last	Last Div
SILVER-LEAD					
Ahumada	New York	5	4⅜	4⅜	Ma. 25,Ap.4,QX 0.12½
Bingham Mines	Boston	52½	48	52½	Se.24, Oc.5 Q 1.00
BunkerHill&Sullivan	N. Y. Curb	107½	100½	107	Jy. 30, Au.4 X 0.75
Cardiff M. & M.	Salt Lake	*42	*40	*42	Feb. 5, 1927 0.10
Chief Consol.	Salt Lake	2.35	2.35	2.35	Nov., 1926 Q 0.10
Consti'nMng.&Mill'g	Spokane	*20	*15	*20	...
Erupcion	Boston Curb	*75	*70	*70	Se. 15, Oc.3 Q 0.07½
Eureka Lily	Salt Lake	1.17½	1.07½	1.17½	...
Federal M. & S.	New York	148	148	148	Jn.25, Jn.29 Spec. $10
Federal M. & S pfd.	New York	95	93	93	Au. 25, Se.15 Q 1.75
Hecla Mining	N. Y. Curb	15⅜	15	15⅛	Au. 15 Se 15 Q 0.25
Highland-Surprise	Spokane	*10	*9	*10	...
Iron King Mining	Salt Lake	*48	*47	*47	...
Keystone Mining	Salt Lake	...	...	*25	Au. 12, Au. 26 0.07½
Lucky Jim	Spokane	*28	*27	*27½	...
Lucky Tiger-Com	Kansas City	†7.00	†6.80	...	Se.10, Se. 20 0.05
Mammoth Mining	Salt Lake	1.90	1.90	1.90	Jn.10, Jn.20 Q 0.05
Marsh Mines	Spokane	*75	*75	*75	...
North Lily	Salt Lake	3.50	3.20	3.50	...
Park Utah	New York	7⅜	7⅛	7⅜	Se. 15, Oc. 1 Q 0.20
Plutus Mining	Salt Lake	1.75	1.70	1.70	Jy. 10, Jy. 15 Q 0.10
Silver King Coal	Salt Lake	8.75	8.75	8.75	Jn. 20, Jy. 1 Q 0.25
Silversmith	Spokane	*21⅛	*18	*19	Oct., 1926 Q 0.02
Strattons Mines	Spokane	*44	*41	*44	...
Sunshine M. Co.	Spokane	1.50	1.25	1.42	...
Tamarack-Custer	Spokane	*23	*21	*22½	Sept., 1924 0.25
Tintic Standard	Salt Lake	12.50	12.00	12.25	Jn.15, Jn.28 0.40
Utah-Apex	Boston	5	4⅛	5	Oct., 1926 0.25
IRON					
Bethlehem Steel	New York	65⅛	62⅛	62⅝	Se. 2, Oc. 1. 1.75
Cleveland-Cliffs Iron	Cleveland	100	92	100	Jy. 15, Jy. 25 Q 1.00
Colorado Fuel & Iron	New York	88	83½	83½	May, 1921 0.75
Gt. North'n Iron Ore	New York	28⅞	24¼	24½	Dec. 6, Dec. 28 0.75
Inland Steel	New York	52¼	51⅛	51⅛	Au. 15, Se. 1 Q 0.62½
Replogle Steel	New York	...	...	12⅛	...
Republic I. & S.	New York	68	66	66¼	Au. 15, Se. 1 Q 1.00
Republic I. & S. pfd.	New York	106	105	106	Se. 15, Oc. 1 Q 1.75
Sloss-Sheffield S. & I.	New York	130	126½	129	Se. 10, Se. 20 Q 1.50
Sloss-Shef. S.&I. pfd.	New York	107	107	107	Se. 20, Oc. 1 Q 1.75
U. S. Steel	New York	160⅛	153⅛	157⅛	Au. 30, Se. 29 Q 1.75
U. S. Steel, pfd.	New York	136⅛	135⅛	136	Au.1, Au. 30 Q 1.75
Virginia I. C. & C.	New York	....	....	45	Jan., 1924 1.50
Virginia I.C.&C. pfd.	New York	....	....	60½	Ju. 15, Jy. 1 2.50
DIAMONDS, PLATINUM, ALUMINUM, VANADIUM, TIN					
De Beers Consol.	New York	...	...	27⅛	Jn. 26, Jn.30 1.45
So. Am. G. & P. New.	N. Y. Curb	3⅛	3⅛	3⅛	...
Alum. Co. of Amer.	N. Y. Curb	101	100	101	...
Alum. Co. of Amer.pf.	N. Y. Curb	104	103	103	Jn. 15, Jy. 1 Q 1.50
Vanadium Corp.	New York	54⅞	52⅛	54⅛	Au. 1, Au. 15 Q 0.75
Patino M. & E.	New York	20	19⅛	20	Ap. 27, My. 5 1 sh.
ASBESTOS					
Asbestos Corp.	Montreal	30	29	29⅞	Jan., 1926 1.50
Asbestos Corp. pfd.	Montreal	93½	93	93¼	Jn.30, Jy.15 Q 1.75
SULPHUR					
Freeport, Texas	New York	82⅞	78⅛	80⅜	Oc.15, No.1 QX 1.50
Texas Gulf	New York	74⅞	67⅛	74	Ju. 1, Ju. 15 Q 1.00
MINING, SMELTING, REFINING AND GENERAL					
Amer. Metal	New York	45	43⅜	44¼	Au.20, Se.1 Q 0.75
Amer. Metal, pfd.	New York	....	....	110⅜	Au.22, Se.1 Q 1.75
Amer. Sm. & Ref.	New York	180½	175¼	177¼	Jn 8, Au. 1 Q 2.00
Amer. Sm. & Ref. pfd.	New York	129⅞	129½	129¼	Au. 1, Se. 1 Q 1.75
Consol. M. & S.	Montreal	237⅞	234	235	Jn. 30, Jy. 15 X 6.25
Newmont Mining	N. Y. Curb	27⅞	24	24⅜	Jn.30, Jy.15 Q 1.00
U. S. Sm. R. & M.	New York	43¾	41	42⅜	Jy. 6, Jy. 15 Q 0.87½
U.S. Sm. R.&M. pfd.	New York	50⅛	50⅛	50⅛	Jy. 6, Jy. 15 Q 0.87½

* Cents per share. † Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. F, four weeks. I, Initial. X, Includes extra. The first date given is that of the closing of the books; the second that of the payment of the dividend.

Boston quotations courtesy Boston Stock Exchange; Toronto quotations those of the Standard Stock Exchange of Toronto, by courtesy of Arthur F. Moysey & Co.; Spokane, Pohlman Investment Co.; Salt Lake, J. A. Hogle & Co.; Colorado Springs, Colo., Henry Sachs.

LONDON QUOTATIONS—WEEK ENDED SEPT. 6, 1927 Last Div.

Name	High	Low	Last	Date	Amount
Aramayo Mines (25 frs.)	76/6	75/—	76/3	Aug., 1927	5 p.c. (†)
British Platinum (£1)	1/6	1/1½	1/6	Feb., 1925	2½ p.c.
Burma Corpn. (10 rupees)	13 4½	12 6	13/—	Aug., 1927	6 annas*
Bwana M'Kubwa (5s)	5/1½	4/10½	5/—	...	...
Camp Bird (2s)	3/3	3/—	3/3	...	...
El Oro (£1)	3/4½	2/9	3/4½	Nov., 1924	2½ p.c.*
Esperanza (10s)	—/3	—/1½	—/3	...	...
Frontino & Bolivia (£1)	14/9	14 7½	14/9	July, 1927	5 p.c.
Mexican Corpn. (£1)	8/4½	8/—	8/—	...	...
Mexico Mines of El Oro (£1)	15/3	15/—	15/—	Dec., 1926	3¾ p.c.*
N'Changa Copper Mining	7/6	7/—	7/6	...	...
Oroville Dredging (£1)	4/9	4/—	4/3	Dec., 1923	1¾ p.c.
Ouro Preto (£1)	2/6	2/—	2/6	May, 1925	2½ p.c
Rhodesian Congo Border (£1)	43/9	40/—	42/6	...	...
St. John del Rey (£1)	10/4½	9/9	10/—	May, 1927	3¾ p.c
San Francisco Mines (10s)	27/6	27/—	27/3	July, 1927	15s.
Santa Gertrudis (£1)	16/3	15/7½	16/3	July, 1927	7½ p.c
Selukwe (2s. 6d.)	9/—	8/6	8/6	April, 1917	6¼ p.c
S. Amer. Copper (2s.)	3/—	2/6	2/9	Nov., 1917	75 p.c
Tanganyika (£1)	63/—	53/6	56 10½	Aug., 1927	7½ p.c
Union Miniere du Haut-Katanga (Brussels)	9.900	9.400	9.450	July, 1927	182.60 (†)

* Free of British income tax † Swiss francs and plus 15 p. c. bonus. ‡ Belgian frs. and free of taxation.

Modern Equipment

Color and Luster as Aids in Mechanical Separation of Minerals

Experimental Machine Developed at Michigan School of Mines Adapts Photo-electric Cell to Ore Dressing

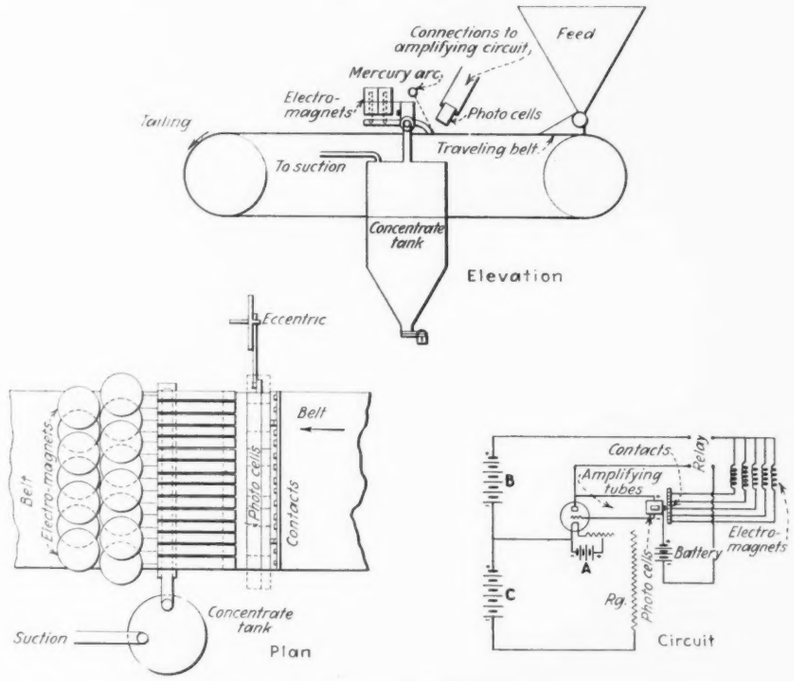
COLOR and luster, as physical properties of minerals, have furnished valuable aids in hand-sorting operations, but otherwise little use has been made of them in ore dressing. The research staff of the Michigan College of Mining and Technology, at Houghton, has been conducting considerable experimentation with the view of developing a mineral concentrate or utilizing these properties. The photo-electric cell, the value of which, in this instance, depends upon the fact that certain minerals are electrically sensitive to light or color change, is the basic feature of the concentrator evolved.

The machine consists of a light-sensitive cell, actuating a relay circuit which mechanically removes any particle causing a change in the quantity of current flowing into the cell. This current is a direct function of the illumination of the photo-sensitive electrode. Removal of minerals from the traveling belt, shown in the accompanying sketch of the machine, is made by suction, a partial vacuum being maintained in the concentrate receiving chamber. Though not as yet perfected in every detail, it is believed this machine points the way to the development of a highly efficient commercial concentrator, which will function on slight differences of color or luster and on either wet or dry material.

This method of making a separation based on color and luster differences applies to aggregates wherein the chemical and gravitational differences are a minimum. Metallic copper is separated from metallic silver while the material is in the concentrate stage. Dry placer minerals, gold, platinum, and tin, can also be selected. Lead sulphide has a color value markedly different from the sulphide of zinc with which it is usually associated. Diamonds have entirely different color values than the blue clays which contain them, and incidentally, the stones differ among themselves and may be classified and graded by the proper use of the color and light-reflecting properties. In fact, there are so many possible applications of the principle, and so many minerals having color and luster of a pronounced order, that it was thought advisable to conduct a series of experiments in an attempt to find some measure of the values and devise some machine which would function on slight differences in the values.

The heart of the selector or concentrator is the photo-electric or light-sensitive cell. These cells are of various types and of varying degrees of sensitivity. The well-known sensitiveness of a thin film of the metal selenium, which when illuminated shows a diminuition in its electrical resistance, was the basis of the first of the series of experiments. Following this, the standard potassium cell now on the market was incorporated into the machine and has been used in all the later experiments. These cells, or tubes, are practically a combination of the standard three-electrode thermionic tube and a photo-sensitive control element. With proper care they last indefinitely; their power consumption is very small and they are extremely sensitive to color or luster change. The small amount of current obtainable from the photo-electric cell as a result of the change in the quantity of illumination may be amplified by the use of one or more thermionic valves and in this manner actuate the relay system which is required for the mechanical removal of the concentrate or the material selected. Relays of a sufficient degree of sensitivity to operate in the cell circuit are now obtainable, so there only remains the work of adapting the system to the minerals or particular metals which are to be selected.

Up to the present the bulk of the investigation has been on the removal of silver particles from copper concentrates. In this, concentrates of silver have been made assaying as high as 4,500 oz. to the ton from the ordinary 20-oz. mill products. This has application in only a limited area, but the principle will be the same for all cases. Tables are being constructed from which may be determined some graded measure of the property which actuates the photo-electric device. This will be done for the common minerals and metals. It is evident that in many cases there is a wider difference between the mineral and the gangue in color and luster than there is in any of their other common physical properties.



Apparatus used for making mineral separations based on color and luster differences

Protecting Grounding Circuits

The constantly increasing use of higher and still higher voltages for electrical distribution systems and the tremendous capacity of the present-day sources of supply are creating a persistent demand for more adequate protective grounding circuits and equipment. The improvements most urgently needed are better mechanical protection for the ground wires and their connections and better methods of connecting the grounding wires to water pipes and conduits, especially conduits having non-conducting coatings.

The Crouse-Hinds Co., of Syracuse, N. Y., is prepared to furnish a complete line of materials for the installation of the most approved types of safety circuits.